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Electrical World

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Persuade the Public of the Benefits of Mergers

EVIDENCE accumulates that 1929 will be an outstanding merger year. If even a few of the indicated consolidations are consummated, along with those which have already taken place, the period will be classed by the economic historians of the future alongside that great merger era in the eighties and nineties. There are billion-dollar bank mergers—billion-dollar utility mergers and other huge consolidations are mooted.

But certain essential differences exist between these two movements. The utilities figure much more prominently in the present movement, and the public assumes a greater interest when the utilities are involved. It takes the "public" in public utilities very seriously. A bank in certain respects is just as much a public servant as a power company, but tradition has evolved a subtle distinction. The public reserves the right to be consulted on any major development in the utility field, while it regards a bank merger as the business of some one else.

Then, again, the older movement carried with it a threat of increasing price levels, in commodities or in services, resulting from restraint of trade as defined in the Sherman and Clayton acts. The current movement is in many respects the reverse. Its object usually is to meet competition or reduce overhead costs, and the trend is to reduce rather than to increase prices. The consumer is more likely to benefit than to lose. Instances of rate reductions and service improvement after consolidations are not lacking in the utility field.

Were the consumers and the general public familiarized by the utilities with these distinctions and with the benefits likely to accrue to them, opposition would gradually change to approval. It is not surprising that the consumer is prone to resent what appears to be utter disregard of his interest in the matter. He naturally expects that if he is to benefit, he will be told how by the promoters of the merger.

* * * *

Permissible Starting Currents

DETERMINATION of what shall be the characteristics of motors when they are started is not a problem for power companies alone or manufacturers alone to solve. Both wish to encourage the maximum use of electricity, and such a result is encouraged when electricity can be applied to its mechanical task with the lowest possible expense, including the cost of motor and accessories and cost of serving the load.

The relation of the size of a motor to the total load fed by one service has considerable bearing on these two elements of cost. For example, the starting current of a 10-hp. motor in a group totaling 1,000 hp. would have no appreciable effect on the size and cost of the service. On the other hand, the manufacturer's cost would be of dominant interest. If the size of the motor is a large proportion of the load served, the power companies' facilities must be designed primarily for the starting current, and therefore the cost of service becomes of dominating interest.

Rational starting rules must take into account both of these factors. Conditions under which the motor will be required to operate should govern the permissible starting currents.

* * * *

Utilities Control No Newspapers, Nor Desire To!

IN WASHINGTON and in Massachusetts investigations of the International Paper & Power Company continue to excite much newspaper comment. Headlines and editorials in many periodicals blaze forth the idea that the "power trust" is trying to control the newspapers. They make little of the statement of Mr. Graustein that "about the best way to ruin a paper is to make it the organ of some special interest. The power side of our business has nothing to do with the newspaper investments." Nor do they point out that Frank D. Commerford, who heads the power part of the business, strenuously opposed the newspaper investments because he thought this action might have a bad effect on public opinion. The fact that Mr. Graustein did what he said other newsprint producers were doing became by inference and innuendo an act of the power industry.

We do not believe it to be good national policy or good commercial policy for any light and power company to invest in newspaper securities. We believe that the International Paper & Power Company acted in good faith, but that these investments were not in conformity with good public policy in the development of the utility industry. Moreover, the exaggerated reports in the public press of the present investigation result in public conceptions of that industry that are untrue.

It is unfortunate that this incident occurred before the industry's story has been told to the Federal Trade Commission. The full testimony before the commission shows that the entire transaction was between a paper producer and newspaper users of his product. Its connection with the light and power business was most remote and was opposed by the executive in charge of this part of the business. In one instance it was testified by men who bought several newspapers that they had no idea the paper company was in the power business and that there was no plan or proposal to influence newspaper opinion by the International Paper & Power Company. These are the facts in an incident to which a position of undue importance has been given in the public press.

The present situation emphasizes the importance of every utility considering its acts in relation to the reac-

tions they may cause against the entire industry. The imagination of the public is quickly stirred by a sensational press, and even the most innocent move on the part of a light and power company may be misconstrued and distorted.

Men of the industry know that the utilities of this country deserve the confidence of the public because they have earned it. They know that light and power companies do not own or control newspapers and would never desire such possessions. But the public is vastly ignorant of utility affairs, and it is the duty of the utilities to acquaint it with their policies and their business. It is an opportune time for each utility to present in straightforward publicity its attitude toward newspapers in its local community, and the national association as well should make a public announcement of its attitude, stating the case clearly and forcibly. Each local incident that may be misconstrued should, for the good of the industry, be treated promptly and vigorously by similar publicity methods. The public ought to know that other companies have no newspaper interests and that newspaper ownership or control is contrary to the common sense of industry executives.

* * * *

Is Customer Ownership Losing Ground?

RECENT advances in market quotations on power-company common stocks, the issuing of valuable rights to subscribe to new shares, the increased cost of borrowing money, the calling of various preferreds and the offering of new sub-senior securities at lower yields have exerted a considerable pressure upon the customer-owner in many cases to shift his holdings into new channels of investment. In some quarters the question is being discussed whether the ownership of power-company shares by customers is "slipping" so far as individuals are concerned, and the future of this movement is receiving close study. It is probably too early to draw the conclusion that the attractiveness of seasoned preferreds is seriously threatened from the customer-owner standpoint. The preferential claims of such issues over commons continue a powerful asset in the mind of the conservative investor, and there appears little ground to apprehend any substantial loss of market for such shares. The probability of increased buying for institutional holdings is strong, and there is not apparent as yet a volume of selling on the part of customer-owners sufficient to disturb the general investment situation.

On the other hand, there is reason to believe that a great number of customer-owners have become sufficiently confident in the future of power-company development to yearn after a larger share in it than is contained in many of the fixed-yield issues. This desire can, of course, be satisfied from time to time by the purchase of listed high-grade common stocks and to a corresponding degree by the acquisition of unlisted shares of properties with apparent or demonstrated earning power. The resale market for utility preferreds distributed widely in customer-ownership activities presents problems in price maintenance on some properties. This however, does not appear to have become acute at this stage.

Customer ownership is undoubtedly increasing in volume through the absorption of more and more common stocks, and the building of a larger structure is contingent upon continued prosperity in the power industry as well as upon inducements to buy senior and sub-senior issues. These inducements may in some cases be merely superior stability of dividends, and in others "sweetening" by convertible or participating features. Enough customer-owners are seeking these features today to make their consideration worth careful study.

* * * *

Lighting That Fails to Do Its Job

IT IS not for want of adequate equipment nor yet of knowledge of physiological or process requirements that a large part of industrial America gropes in nerve-wracking glares, shadows and under-illumination. Thoroughly modern buildings have in almost every instance thoroughly modern lighting facilities and layouts with adequate characteristics, but industrial America includes thousands of ancient shops, mills, factories and offices in which all-but-criminal conditions of seeing persist.

The utility companies whose commercial departments are making other than somewhat desultory efforts to insure proper use of light are really few and far between. In discussing methods and procedures with the commercial manager of one of the smaller utilities an editor of this publication received a somewhat glowing account of what was being accomplished in the locality. The manager's office had been recently redecorated and handsome semi-indirect fixtures fastened to the two old outlets in the ceiling. It was a well-lighted office except for the fact that of the seven persons working in it two labored in their own shadows and three suffered a horrible reflected glare from the high-intensity aisle-centered sources.

The reason that industry so often gropes is a lack of knowledge by engineers and executives regarding the supreme importance of light and its effect upon the health, output and general attitude of their workers. The idea that when the sun shines artificial lights are unnecessary is still rather firmly intrenched. That artificial light, properly selected, engineered and studied can be superior to daylight is a largely unaccepted heresy in the minds of practical conservatives. The era of good lighting can be brought about only by the dissipation of ignorance on this subject. Education and example will, if properly pushed as a business idea, ultimately bring light to many of the darker corners.

* * * *

Scotched but Not Yet Killed

A REASONABLY good modern radio set can receive local programs with acceptable volume and still remain above the noise level of any except very bad interference. Moreover, the larger metropolitan districts are favored in that virtually all high-voltage transmission is by underground cable and one prolific source of annoyance is thus removed very largely from consideration. There remain only low-tension faults and faults in the customer's appliances to cause trouble, and in a large city these must be very close to a set and very strong to cause numerous radio complaints.

But how different is the condition in the country and in the small towns! Radio receivers are screwed up to a high state of sensitivity. If they are regenerative, as many are, they tremble on the verge of oscillation in normal operation to gain that last increment of am-

plification necessary to catch a station fifty, a hundred or two or three hundred miles away. Electrical circuits are not ensconced under ground. High-tension lines stride across the countryside and through the towns. Distances are great and loads, measured by the standards of big cities, are small. They are patrolled and maintained, certainly, but it is obvious that a line carrying 10 amperes at 33,000 volts to a little hamlet cannot get economically the same attention and care as are given to a heavily loaded system tie. There are many such lightly loaded high-voltage lines meandering up and down the face of the land, and each of these lines as a potential source of radio interference. A single faulty insulator may not only set up interference in its immediate vicinity but this interference may be propagated for many miles along the line.

It is unnecessary to state that the utilities on whose lines interferences are found are doing their utmost to mitigate them. Quite aside from the very acute feeling of public responsibility they have, the utilities are anxious to rid their lines of interference conditions purely from the standpoint of good and economical operation, for every radio interference is a fault in embryo. Therefore, while interference is a problem of no inferior magnitude in the territories of wide-flung systems, there is an active disposition to attack it, to conquer it and to file the record away finally with the records of other famous victories.

* * * *

Transformer Tap Changers Should Be Accessible

A TRANSFORMER tap changer, even if operated only when the transformer is disconnected on both sides, is a switch and should be considered as such. Any switch, even a lever switch for low voltage, requires periodic inspection, with cleaning of contacts, adjustment of springs, tightening of nuts, and so on. Such switches are generally easily accessible for inspection, are frequently inspected and minor faults are repaired in time. Trouble from this source is, therefore, quite rare. But even on oil switches, which are comparatively accessible for contact inspection, contact troubles are still more frequent than they should be, for the obvious reason that whereas on open switches the operator cannot help seeing the contacts now and then, even when not bent on inspection, when an oil switch contact is to be inspected it is necessary to kill the circuit and remove the tank. The conditions are considerably more complicated in the case of transformer tap changers. These changers are generally arranged on top of the transformer, and in order to get at the contacts it is necessary to remove the manhole cover, which in the case of large outdoor transformers cannot be done outdoors for various obvious reasons. The transformer has to be moved into the repair house—somewhat of a construction job in itself—and taken out of service for some time. The result is that the contacts are not inspected at all, and even the well-designed tap changers are quite frequently the cause of transformer shutdowns.

Transformer designers should give this matter their serious attention and should attempt to bring out designs which will make the tap changer more accessible. Perhaps the tap changer could be placed in a separate small oil container, with a valve to shut off the oil connection to the main transformer oil. This small container could be installed on top of the transformer, but preferably on the side, within reach from the ground. It would be a small matter to drain the small amount of oil in the tap-changer container and inspect the contacts. It should be easy to provide interlocks which would prevent the transformer from being placed back in service without properly locking the tap changer in place.

Perhaps better means than the one suggested here can be found. But transformer designers should realize that tap changers are more important than push-buttons. They are very important switches, and their care is as important as that of oil circuit breakers, if not more so. They should be so built that their contacts can be inspected without the use of construction equipment and the aid of a wrecking crew.

* * * *

Does Utility Advertising Pay?

MANY reasons exist for utility advertising. It is a straightforward method for reaching the public in the communities served and it is a tool all business has found essential to economical selling. Newspapers, billboards, leaflets, motion-picture films and other current means of advertising should be used and used in volume.

But advertising is an art and many utilities have not learned this art. It is hopeless to expect results when an executive simply hires an advertising manager and then dismisses the matter from his mind. The secret of good advertising is, first, good copy and, second, good display, and the executives are essential aids to the production of good copy. Utility advertising should strike out along original lines, it should be unselfish, it should be written from the viewpoint of the reader, it should never complain, it should be continuous, and it should be interesting. These typical specifications are too general to be of much direct help to the man who writes the copy. The executive, however, should have ideas for copy that spring from his desire to promote both community growth and company growth.

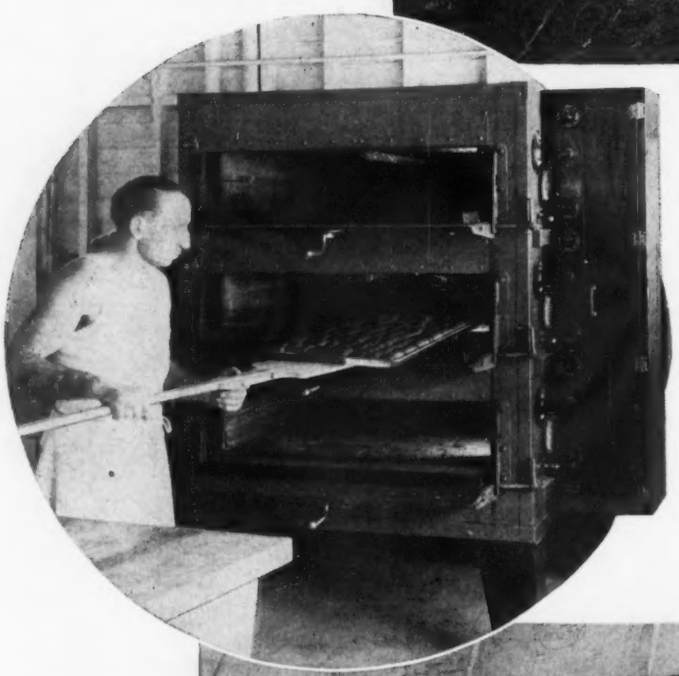
An interesting example of this kind of advertising was developed by the Texas Power & Light Company. The slogan "Texans, Let's talk Texas" was the idea around which facts about Texas were presented. Favorable comment resulted and Texans did begin to talk Texas. Many analogous ideas for good newspaper advertising will suggest themselves. There is no value in simply spreading a company name on a newspaper page. Simple, direct, interesting copy should be presented in an interesting manner.

Splendid advertising can be had with billboards on construction jobs, at outdoor substations and along transmission lines. People are curious about the ownership of these structures, and they like to watch men work. Billboards should tell people about the structures, tell what they mean to the community, tell why they were built, tell how big they are and even tell what they cost. All parts of a system lend themselves to the presentation to the passing public of attractive and interesting bits of fact or policy.

Good business practice is to spend from one to three per cent of gross revenue on advertising, yet the utilities spend less than one-half of one per cent. Larger expenditures are undoubtedly justified provided that the money is spent intelligently. Utility advertising is a branch of the business. It should receive the same executive attention as do the other branches. If this be done, advertising will help pay dividends.

Construction Camp Cooks Meals Electrically

In thirty-eight workmen's cottages electric ranges have been installed



FOR the next five years an average force of 1,800 men working on the construction of the San Gabriel Dam near Los Angeles will eat electrically cooked meals. The Southern California Edison Company, in co-operation with restaurant equipment supply houses, has made a complete electrical cookhouse for the project. The equipment includes a three-deck bakeoven, two-deck roasting oven, four cooking tops and two large griddles.

Better working conditions, avoidance of handling fuel and reduced fire hazard were among reasons for installing electrical cooking equipment

Tower Footing Tests

Validate Design

Tests of concrete tower foundations indicate value of undercut in resisting uplift forces. Sutdy of load-deflection curves, construction problems and probable costs results in adoption of new footing

By WALTER DRYER

Assistant Engineer Division of Civil Engineering, Pacific Gas & Electric Company, San Francisco, Calif.

POSSIBILITY of reducing construction costs by so modifying the design of the standard concrete foundations for transmission-line towers as to supplant hand excavation by power methods led to a series of tests by engineers of the Pacific Gas & Electric Company. Information obtained from these tests, together with an analysis of the probable cost of each type, resulted in the adoption of a foundation the excavation for which was made with a 36-in. power-operated auger, a slight undercut being added at the bottom of the hole. The new type of foundation is being utilized where field conditions permit access with the power auger on the recently completed Newark-Morgan Hill 110-kv. tower line.

The tests made at this time were confined to footings for the standard straight line 110-kv. towers. The original footing of the pad and pedestal type, designed under the more or less conventional assumption of a 30-deg. cone of resistance to uplift forces, will still be used in sandy soils or wherever it is impracticable to utilize the hole digger. This footing, as well as the new type, is illustrated. Test specimens were set in the typical alluvial soil formation of the floor of the Sacramento Valley.

TYPES OF FOOTINGS TESTED

Three general classes of footings were tested:

Class I—Expanded Bulb Type (tests Nos. 1 to 6, inclusive): This type was made by drilling a relatively small diameter hole with an expanded bulb at or near the bottom, inserting a stub therein and filling the hole with concrete. Seven footings included in this classification were tested—specimens Nos. 1 and 2A were made by expanding the bottom of the hole with an underreamer; specimens Nos. 3 and 4 by drilling the hole to the diameter of the bulb and backfilling the narrow annular space between the concrete and the earth with well-tamped earth; specimen No. 5 was of the Malone type and specimen No. 6 was a modification of the Malone type with a larger diameter stem. The expanded bulb was obtained for the two latter specimens by springing the auger hole with dynamite.

Class II—Circular Pad and Pedestal Type (tests Nos. 38, 38A and 39): This type was constructed by drilling a 36-in. diameter hole with a power auger, constructing a base at the bottom of the hole and pouring a pedestal against the undisturbed earth on the side toward the center of the tower. With this construction the horizontal forces are transmitted from the tower base into the undisturbed earth against which the pedestal is

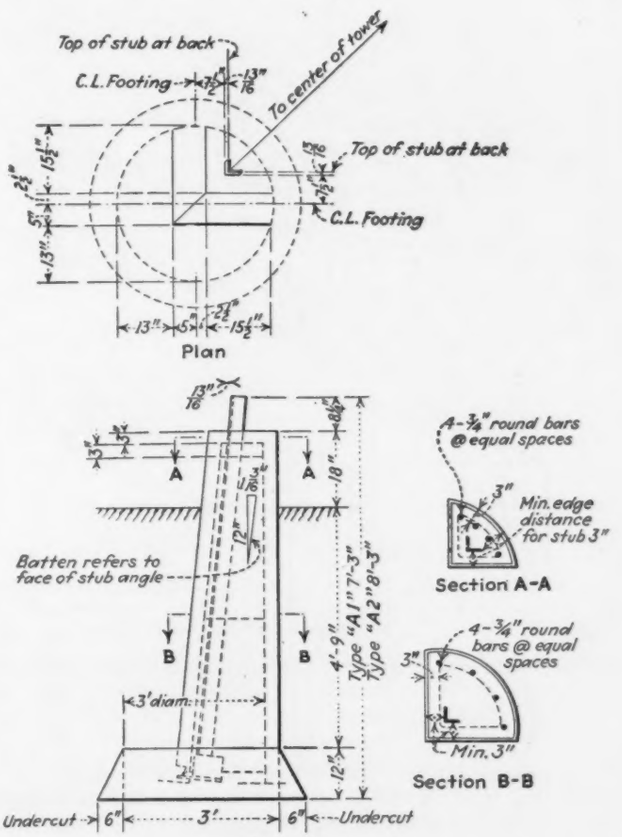


Fig. 1—New Type of Tower Footing Adopted as Result of Tests

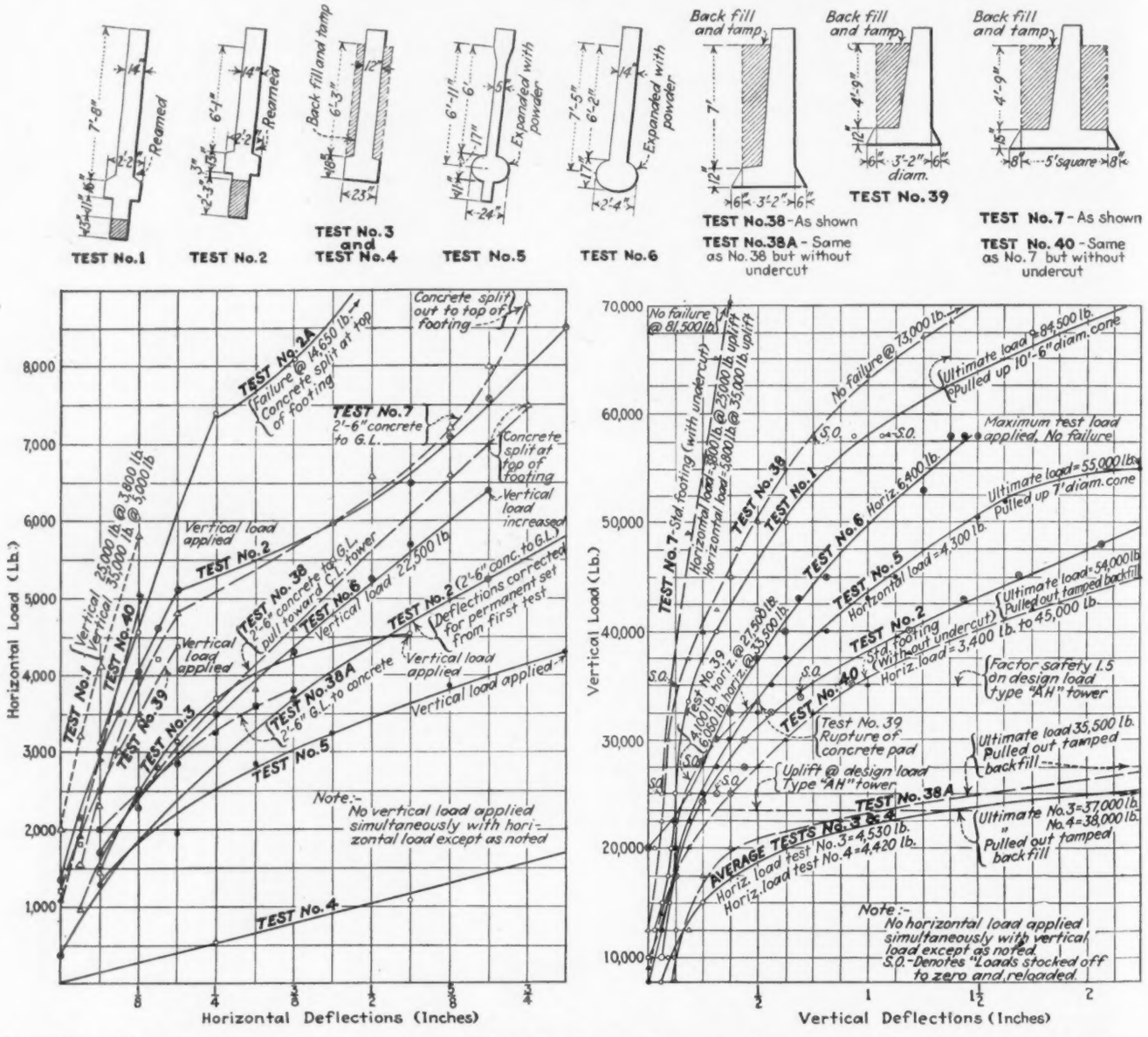
poured, rather than being carried down into the base slab. The holes for specimens Nos. 38 and 38A were 8 ft. deep, while that for specimen No. 39 was 5 ft. 9 in. deep. An undercut was provided for specimens Nos. 38 and 39. These tests were designed to furnish

information on the effect of the undercut and of varying the depth.

Class III—Rectangular Pad and Pedestal Type (tests Nos. 7 and 40): This type was the same as the original design of footing, wherein a rectangular hole was excavated by hand, a slab poured in the bottom of the hole and a pedestal constructed on this slab, the pedestal

wires and the loads which the structure must withstand are shown in Table I.

The most severe combination of loads transmitted to any of the footings of the tower is an uplift of 23,500 lb., occurring either simultaneously with or independently of a horizontal load of 3,650 lb. The simultaneous application of these loads produces the greatest


TEST No.1
TEST No.2
TEST No.3 and TEST No.4
TEST No.5
TEST No.6
TEST No.38 - As shown
TEST No.38A - Same as No.38 but without undercut
TEST No.39
TEST No.7 - As shown
TEST No.40 - Same as No.7 but without undercut
Back fill and tamp
Expanded with powder
Reamed
Horizontal Load (Lb.)
Horizontal Deflections (Inches)
Vertical Load (Lb.)
Vertical Deflections (Inches)
Concrete split out to top of footing
Vertical load applied
Vertical load increased
Deflections corrected for permanent set from first test
Note:- No vertical load applied simultaneously with horizontal load except as noted
Maximum test load applied. No failure
Ultimate load = 55,000 lb.
Pulled up 7' diam. cone
Ultimate load = 54,000 lb.
Pulled out, tamped backfill
Factor safety 1.5 on design load type "AH" tower
Test No. 39 Rupture of concrete pad
Uplift @ design load Type "AH" tower
Ultimate load 35,500 lb.
Pulled out, tamped backfill
AVERAGE TESTS No. 3 & 4
Horiz. load test No. 3 = 4,530 lb.
Horiz. load test No. 4 = 4,420 lb.
Ultimate No. 3 = 37,000 lb.
No. 4 = 38,000 lb.
Pulled out tamped backfill
Note:- No horizontal load applied simultaneously with vertical load except as noted.
S.O.-Denotes "Loads stocked off to zero and reloaded"

Figs. 2 and 3—Footing Designs Indicate Relationships Between Horizontal Loads and Deflections and Uplift Forces and Vertical Deflections

being located approximately over the center of the pad. With this type of construction it is necessary to design the pedestal to transmit the horizontal loads from the base of the tower down to the pad, as no reliance can be placed on the relatively loose backfill surrounding the pedestal. Specimen No. 7 differed from No. 40 only in that it was constructed without an undercut.

The standard double-circuit straight-line towers are designed to withstand safely the breakage of three wires comprising one circuit, these wires being supported in a vertical configuration on one side of the tower. The dimensions of the tower, arrangement and spacing of stresses in the pad and in the stem reinforcing as well as producing greatest deflection. The independent application of the horizontal load produces greatest stresses in the concrete of the stem.

Method of Testing

Horizontal and vertical pulls were made by means of a power winch mounted on a 5-ton truck and geared to the truck motor, the fall line for the vertical pull acting through two sets of triple sheave blocks suspended from an "A" frame and through a single set of triple sheave blocks for the horizontal pull. Deadmen

were suitably placed for anchoring the "A" frame and fall line blocks.

Axial test loads were measured by means of a Martin-Loomis tension indicator (No. 114) with a 100-lb. gage. The equipment necessary for adapting the tension indicator to the footing test rigging consisted of an assembly of equalizing or beam reduction plates. Horizontal test loads were measured by means of a 10,000-lb. Chatillon dynamometer with the use of an equalizing beam with a two to one ratio for higher pulls. Horizontal and vertical deflections were read by means of a transit to obtain load deflection curves for both the horizontal and the combination of horizontal and vertical pulls.

Result and Interpretation of Tests

Results of the tests are shown graphically in Figs. 2 and 3. The former shows the deflection curves for horizontal loads either alone or in combination with vertical loads, while the latter gives similar information on vertical deflections for combined horizontal and vertical loads.

The resistance to horizontal forces as shown in Fig. 2 roughly indicates three general groupings as to resultant deflection. The first group gives a deflection of $\frac{1}{8}$ in. or less at maximum design loading and includes tests Nos. 1, 2, 2A, 7, 39 and 40. Test No. 2A was designed to be carried to failure under horizontal load only and indicates that a 14-in. diameter hole filled with concrete placed against original undisturbed earth can resist forces of considerable magnitude. The second group gives deflections between $\frac{1}{4}$ and $\frac{3}{8}$ in. at maximum load and includes tests Nos. 3, 6, 38, 38A and a modification of test No. 2, in which the load was applied at a distance of 2 ft. 6 in. instead of 1 ft. 6 in. above the ground line. The third group gave deflections in excess of $\frac{1}{2}$ in. under maximum load and includes tests Nos. 4 and 5.

The resistance to combined horizontal and vertical loads first indicates the inadequacy of tests Nos. 3, 4 and 38A in resisting uplift forces. None of these was made with an undercut and in all cases the footings pulled out along the line of excavation without bringing up a cone of earth with them in spite of the fact that they had been in the ground six months, this period including the winter season.

Table I—Data on Standard Straight-Line Tower

Height —Over all, ft	83	Conductor, 250,000 circ.mil copper	
To lower crossarm, ft.	58	No. wires broken, three in one circuit	
Width —At base, ft	16	Max. tension per wire, lb.	7,540
At crossarm, ft	4½	Weight of tower, lb.	5,080
Conductor separation			
Between phases, ft.	10		
Between circuits, ft.	17½		

Table II—Resistance to Uplift Increased by Providing Undercut at Bottom of Hole

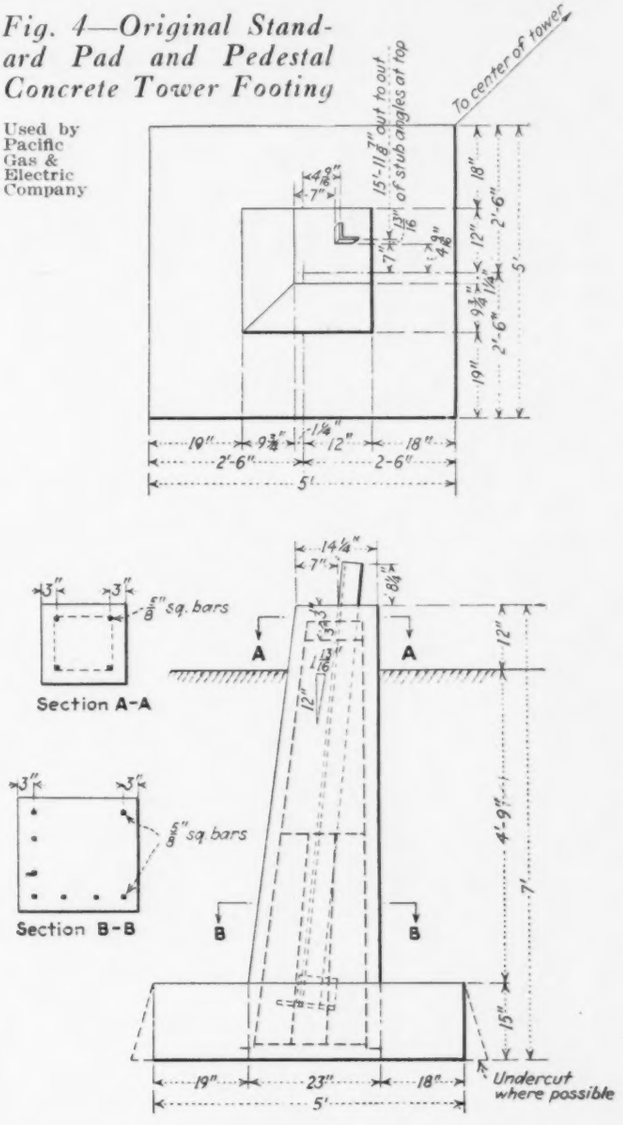
Test No.	Undercut	Vertical Deflection (In.) at Design Load	Test Load	Ultimate Load	Ultimate Load, Lb.
2	Yes	$\frac{1}{4}$	$\frac{1}{4}$	4 $\frac{3}{16}$	55,000
3 and 4	No	1$\frac{1}{4}$	..	6	37,000
4	No	1 $\frac{7}{16}$	..	9	38,000
38	Yes	$\frac{1}{16}$	$\frac{1}{8}$	1$\frac{1}{4}$	73,000*
38A	No	1$\frac{1}{4}$	$\frac{5}{8}$	8$\frac{1}{4}$	35,800
7	Yes	$\frac{1}{16}$	$\frac{1}{4}$	$\frac{1}{2}$	81,500*
40	No	$\frac{1}{16}$	1	4$\frac{1}{2}$	54,000

* No failures at this load.

The remaining tests, all successful in resisting the uplift forces with a satisfactory factor of safety, may be divided into three classes. Tests Nos. 1, 7 and 38 gave deflections less than $\frac{1}{4}$ in. at test load ($1\frac{1}{2}$ times design load). Tests Nos. 5 and 6 and test No. 39, which failed just short of test load, gave deflections of about $\frac{1}{2}$ in. Specimen No. 39 ruptured at the juncture of the stem and pad due to the inclusion of dirt at the construction joint, and aside from this gave satisfactory performance in the load-deflection study. This structural defect did not exist in specimen No. 38, which successfully withstood a load nearly $2\frac{1}{2}$ times as great as that which ruptured No. 39. The only difference in design between these footings was the inclusion of stub bars joining the pad and stem of No. 38 and which were not included in No. 39. Tests Nos. 2 and 40 gave deflections greater than $\frac{1}{2}$ in., but less than 1 in. at test load.

Fig. 4—Original Standard Pad and Pedestal Concrete Tower Footing

Used by Pacific Gas & Electric Company



Direct comparisons can be made between certain of the footings to indicate the great increase in resistance obtained by providing a very slight undercut at the bottom of the hole. This comparison is shown in Table II and includes only those footings which are identical in design, except for the undercut.

Table III—Relation Between Actual and Calculated Resistance to Uplift

Test No.	Ultimate Resistance Actual	Ultimate Resistance Calculated	Ratio Actual to Calculated	Remarks
1	84,500	30,000	2.82	
2	55,000	17,000	3.24	
3	37,000	17,000	2.24	Backfilled and tamped. Installed 7½ months before test.
4	38,000	17,000	2.24	
5	55,000	19,000	2.90	
38A	35,500	35,000	1.00	Backfilled and tamped. Installed two weeks before test.
40	54,000	35,000	1.55	

The effect of varying the depth of footings of similar design can be obtained by comparing test No. 1 with No. 2 and test No. 38 with No. 39. Unfortunately, the latter comparison can be made only to the point at which specimen No. 39 failed, but even within that limit there is a very decided difference in the characteristics of the load-deflection curves. The comparison between specimens Nos. 1 and 2 can be made from zero to the load producing the failure of each type.

Some interesting comparisons can be made to show the relation between the ultimate resistance to uplift as calculated by the more or less conventional 30-deg. cone method with values actually obtained by test. These relations are shown in Table III.

Another interesting relation was brought out when comparing the deflections obtained with the undercut footings in this test. The ratio of the load at any given vertical deflection (less than one inch in magnitude) to the ultimate load seems to be fairly constant for the several undercut types. This is shown in Table IV.

It will be noted that for small deflections the ratios are fairly constant. If this feature should prove to hold over a greater range than that used in this test it may afford a method for determining the approximate value of the ultimate resistance by testing an occasional footing to partial load. If such tests were made without producing excessive deflections the footing would still be useful as one of the tower supports.

A careful check was made by the members of the line construction department on the actual quantities of materials, truck-hours and man-hours of labor required for the complete installation of each type of foundation. Table V summarizes this information and includes an estimate of the cost of each type of footing. In addition to obtaining the information necessary for a reasonably accurate estimate of cost, notes were made with respect to construction difficulties inherent with some of the types under test. Some of the more important of these notes are as follows:

Types Nos. 1, 2, 3, 4 and 6—After reaching a depth of 4 or 5 ft. the auger would not clear itself, it being necessary for a man to scrape off the dirt with a shovel. Apparently the hole digger will not dig holes on a true batter when digging to a depth in excess of 8 to 10 ft.

When lowering the stubs into position, it was impossible to prevent knocking a fairly large amount of earth into the hole, this being mostly due to the batter of the hole.

With the 12-in. diameter holes there is so little clearance between the stub and the sides of the hole that if the holes are off center a slight amount it would be impossible to set the four footings of the tower without resorting to a considerable amount of hand excavation. It will be difficult to dig 12-in. diameter holes with a power auger accurately enough to permit the setting of the stubs without additional hand excavation, which also increases the amount of concrete required.

Table IV—Ratio of Intermediate to Ultimate Load for Various Deflections

Test No.	Ultimate Load	Deflection ¼ In.	½ In.	¾ In.	⅞ In.	1 In.
1	84,500	0.296	0.445	0.550	0.634	0.685
2	55,000	.320	0.440	0.570	0.638	0.695
5	55,000	0.342	0.458	0.610	0.715	0.785

Tests Nos. 38, 38A and 39—While setting the forms of these footings it was impossible to prevent knocking down dirt onto the concrete pad at the bottom of the hole.

Conclusions

A study of the test data shows the following:

Specimens Nos. 1, 7 and 38 were *too conservatively designed* for this type of tower.

Specimens Nos. 3 and 4 were *inadequate in strength.*

Specimens Nos. 38A and 40 were about as *costly* as Nos. 38 and 7 respectively, and their *performance* under test was *less satisfactory* than other types which were constructed at less expense.

Specimens Nos. 2, 5, 6 and 39 gave *satisfactory* per-

Table V—Quantities of Materials, Truck and Labor Time and Estimated Cost of Different Types of Tower Footings

Specimen No.	1	2	2A	3	4	5	6	7	38	38A	39	40
Class	I	I	I	I	I	I	I	III	II	II	II	III
Type	Under-reamed	Under-reamed	Under-reamed	Back-filled	Back-filled	Malone	Malone	Rect. Pad. and Pedestal	Circ. Pad. and Pedestal	Circ. Pad. and Pedestal	Circ. Pad. and Pedestal	Rect. Pad. and Pedestal
Excavation, cu.ft.	16.0	13.5	15.0	21.5	22.0	1.5	8.5	.....	.....	.....	.....	.....
Excavation, cu.yd.	.....	.....	.....	.....	.....	.....	.....	4.0	2.4	2.3	1.9	5.6
Concrete, cu.ft.	15.0	12.0	13.0	10.0	11.0	4.0	12.0	40.0	27.0	24.5	16.2	46.0
Weight of stub and reinforcing, lb.	214	167	142	167	167	142	79	125	105	105	73	125
Truck time, excavation, minutes	56	39	42	18	14	.....	18	20	15	12	10	.....
Labor excavating and placing forms and stubs, man-hours	1.25	1.00	1.00	1.75	1.25	2.50	3.00	5.00	5.00	5.33	3.25	8.83
Estimated costs:												
Concrete at 80 cents	12.00	9.60	10.40	8.00	8.80	3.20	9.60	32.00	21.60	19.60	13.00	36.80
Steel at 5 cents	10.70	8.35	7.10	8.35	8.35	7.10	3.90	6.25	5.25	5.25	3.65	6.25
Labor at 50 cents	0.65	0.50	0.50	0.90	0.65	1.25	1.50	2.50	2.50	2.65	1.65	4.40
Truck at $4.80 per hour = 6 cents per minute	3.35	2.35	2.50	1.10	.80	.....	1.10	1.20	0.90	0.70	0.60	.....
Total per footing	26.70	20.80	20.50	18.35	18.60	11.55	16.10	41.95	30.30	28.20	18.90	47.45

Notes: Truck time includes time of driver and operator. Man-hours labor includes any additional labor required in excavating hole, placing forms, stubs and reinforcing, but not labor of placing concrete.

Table I—Data on Output and
Syst

These data include all public utility, lighting, power and electric

Line No.	Company* or System	Rank in 1928	1928							
			System Peak Load Kw. (Instantaneous)	System Peak Load (Est. Over Thirty-Minute Period) Kw.	Date of Instantaneous System Peak	Output for Year Kw.-Hr. (Including Purchased Energy)	Average Load in Kw. 1928	System Peak Load Kw. (Instantaneous)	Syste Peak L (Est. O Thirty Minu Perio Kw.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	United States								
1	Buffalo, Niagara & Eastern Power Corporation System (*C*)	1	751,900	736,887	Dec. 19	4,832,459,513	550,000	732,400	715,
2	The New York Edison and Allied Companies (*H*)	2	1,146,000	1,125,000	Dec. 20	4,210,700,000	479,000	784,077	765,
3	Commonwealth Edison Company	3	1,050,000	1,016,000	(*n*) Dec. 21	4,174,661,000	475,000	952,000	916,
4	Southern California Edison Company	4	516,100	.....	Oct. 26	2,762,459,843	314,500	448,900	.....
5	Pacific Gas & Electric Company	5	484,600	.....	Dec. 14	2,545,713,564	289,800	439,568	.....
6	The Detroit Edison Company	6	509,300	(*a*) 507,700	Nov. 19	2,438,304,900	277,600	447,500	(*a*) 443
7	Southeastern Power & Light Company System*	7	.....	505,000	.....	2,358,032,225	268,400	.....	475
8	The Philadelphia Electric Company System (*T*)	8	581,000	561,400	Dec. 17	2,266,856,345	258,000	455,000	447
9	Public Service Electric & Gas Company (N. J.)	9	480,500	471,000	Dec. 17	1,879,024,063	213,900	435,500	422
10	Duke Power Company*	10	422,600	422,600	Oct. 9	1,847,072,621	210,300	.....	398
11	The West Penn Electric Company Subsidiaries	11	.....	(*o*) 319,325	.....	1,764,742,160	201,000	.....	(*b*) 332
12	The North American Co. System (Mo., Ill. & Iowa Group)	12	355,611	.....	Dec. 17	1,719,825,708	195,800	319,599	.....
13	The Montana Power Company	13	.....	.....	.....	1,583,985,000	180,300	191,100	187
14	The North American Company System (California Group)	14	290,390	.....	July 25	1,537,851,047	175,100	271,665	.....
15	Duquesne Light Company	15	295,300	.....	Dec. 11	1,434,185,024	163,300	276,900	274
16	Mohawk Hudson Power Corporation System	16	.....	.....	.....	1,388,274,167	158,000	.....	(*c*) 257
17	New England Power Association System	17	.....	(*b*) 315,000	(*o*) Dec. 11	1,384,834,239	157,700	.....	(*o*) 243
18	The Ohio Power Company	18	224,000	.....	Dec. 11	1,305,004,000	148,500	211,000	.....
19	The Cleveland Electric Illuminating Company	19	331,768	.....	Oct. 23	1,282,476,855	146,000	293,731	285
20	Appalachian Electric Power Company	20	230,000	.....	Dec. 18	1,270,328,000	144,600	216,000	.....
21	Pennsylvania Power & Light Company*	21	(*A*) 253,000	.....	(*A*) Dec.	1,176,653,000	133,900	(*A*) 203,002	.....
22	The North American Co. System (Wis.-Michigan Group)	22	262,860	.....	Nov. 19	1,148,886,380	130,800	229,314	.....
23	Consumers Power Company	23	232,980	230,000	Dec. 17	1,102,278,322	125,500	225,919	225
24	Brooklyn Edison Company, Inc. (*I*)	24	(*O*) 330,000	325,000	Dec. 20	1,076,612,618	122,600	265,000	263
25	Columbia Gas & Electric Corporation System	25	252,000	249,000	Dec. 4	1,052,549,327	119,800	213,000	.....
26	Public Service Company of Northern Illinois	26	.....	178,016	Dec. 13	1,047,466,830	119,200	.....	(*G*) 154
27	Northern States Power Company and Subsidiaries	27	.....	.....	.....	908,760,906	103,500	.....	.....
28	Puget Sound Power & Light Company	28	169,219	.....	Dec. 20	877,953,546	100,000	158,453	155
29	The Edison Electric Illuminating Company of Boston	29	252,777	.....	Nov. 2	857,209,496	97,600	224,508	.....
30	Utah Power & Light Company	30	(*A*) 132,390	.....	(*A*) Dec.	830,862,000	94,600	(*A*) 118,678	.....
31	Consolidated Gas Elec. Lt. & Pwr. Co. of Baltimore	31	.....	(*b*) 167,900	(*o*) Dec. 20	825,430,643	94,000	.....	(*c*) 165
32	The Washington Water Power Company	32	.....	.....	.....	746,709,000	85,000	128,120	113
33	The Tennessee Electric Power Company	33	152,200	145,300	Mar. 9	730,061,103	83,100	137,800	129
34	Pennsylvania Water & Power Company	34	(*i*) 129,000	(*c*) 124,500	Dec. 5	655,035,700	74,600	(*i*) 127,000	(*c*) 120
35	Pennsylvania-New Jersey Power System (*V*)	35	(*i*) 150,000	(*b*) 143,500	Dec. 5	645,621,149	73,500	(*i*) 140,000	(*b*) 132
36	City of Los Angeles, Bureau of Power & Light	36	153,200	152,000	Dec. 10	639,415,709	72,800	133,300	132
37	Northern New York Utilities, Inc.	37	134,890	134,890	Sept. 4	612,905,709	69,800	97,580	97
38	The Pennsylvania-Ohio System	38	.....	(*o*) 132,233	Oct. 23	606,647,383	69,100	.....	(*b*) 113
39	Kansas City Power & Light Company	39	127,300	120,300	Dec. 21	584,714,544	66,600	.....	(*h*) 120
40	Oklahoma Gas & Electric Company	40	.....	.....	.....	567,869,411	64,600	.....	.....
41	The Ohio Public Service Company	41	.....	(*b*) 111,800	(*o*) Dec. 18	559,090,541	63,700	.....	(*c*) 98
42	Portland Electric Power Company	42	.....	(*b*) 128,500	(*o*) Jan.6	549,922,100	62,600	.....	(*b*) 120
43	Hetch Hetchy Water Supply City & County of San Francisco	43	82,400	82,400	June 9	528,895,495	60,200	.....	.....
44	Idaho Power Company	44	(*A*) 72,080	.....	(*A*) Nov.	506,009,000	57,600	(*A*) 70,245	.....
45	~~The Toledo Edison Company~~	45	.....	100,020	(*n*) Dec. 14	458,973,651	52,300	.....	(*c*) 81
46	Indiana & Michigan Electric Company	46	91,560	.....	Oct. 29	454,600,000	51,800	90,110	.....
47	The Connecticut Light & Power Company	47	.....	.....	.....	445,804,848	50,800	.....	.....
48	The California Oregon Power Company	48	.....	.....	.....	441,845,615	50,300	.....	.....
49	Virginia Electric & Power Company	49	.....	95,100	(*n*) Dec. 7	440,886,606	50,200	.....	(*a*) 88
50	Houston Lighting & Power Company	50	(*A*) 82,600	.....	(*A*) Oct.	436,633,000	49,700	(*A*) 75,000	.....
51	Carolina Power & Light Company	51	(*A*) 107,000	.....	(*A*) Oct.	430,427,600	49,000	(*A*) 101,000	.....
52	Associated Gas & Electric System (Penna. Elec. Corp. Group)	52	84,386	.....	Oct. 23	429,933,355	49,000	89,500	87
53	Minnesota Power & Light Company	53	(*A*) 80,696	.....	(*A*) Aug.	416,134,000	47,400	(*A*) 77,950	.....
54	Potomac Electric Power Company	54	110,500	108,000	Nov. 26	413,992,663	47,100	101,000	98
55	Turners Falls Power & Electric Company	55	.....	98,400	Dec. 28	413,187,644	47,000	.....	.....
56	Louisiana Power & Light Company	56	(*A*) 92,553	.....	(*A*) Oct.	390,533,000	44,400	.....	.....
57	Central Indiana Power Company Subsidiaries	57	.....	(*c*) 84,205	(*o*) Dec.	383,337,429	43,600	74,100	74
58	Texas Electric Service Company	58	(*A*) 67,494	.....	(*A*) Oct.	381,404,000	43,400	.....	.....
59	Northern Ohio Power & Light Company	59	.....	80,300	.....	.....	.....	.....	.....

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Peak Load of Largest Generating stems in North America

tric railway systems in the United States, Canada and Mexico having yearly output in excess of 100,000,000 kw.

1927				1926					1925		
System ak Load st. Over Thirty-Minute Period) Kw. (10)	Date of Instantaneous System Peak (11)	Output for Year Kw.-Hr. (Including Purchased Energy) (12)	Average Load in Kw. 1927 (13)	Peak Load Kw. (Instantaneous) (14)	Peak Load (Est. Over Thirty-Minute Period) Kw. (15)	Date of Instantaneous Peak (16)	Output for Year Kw.-Hr. (17)	Average Load in Kw. 1926 (18)	Peak Load Kw. (Instantaneous) (19)	Date of Instantaneous Peak (20)	Output for Year Kw.-Hr. (21)
715,100	Dec. 2	4,634,341,084	529,000	68,800	682,800	Dec. 9	4,463,911,125	509,580			
765,703	Dec. 13	2,877,090,621	328,300	731,964	710,714	Dec. 20	2,554,025,704	291,555	656,312	Dec. 21	2,262,620,409
916,000	Dec. 8	3,778,380,000	431,300	897,000	867,000	Dec. 15	3,482,632,000	398,000	809,000	Dec. 23	3,091,424,000
.....	Dec. 9	2,421,357,098	276,300	422,700	.....	Nov. 9	2,227,879,772	255,004	395,900	July 22	1,987,661,654
.....	July 29	2,322,015,035	265,100	406,970	.....	Dec. 22	2,157,886,980	246,334	380,084	Nov. 4	2,001,474,640
443,800	Dec. 20	2,142,549,100	244,500	439,000	(a) 435,000	Sept. 15	2,025,063,700	231,200	391,000	Oct. 2	1,732,420,700
475,000	(n) Oct. 24	2,215,947,000	253,000	(B) 420,000	400,000	Oct. 8	1,966,393,998	224,210	291,000	Oct. 22	1,196,244,494
447,300	Dec. 19	1,860,613,091	212,400	444,000	431,500	Dec. 20	1,749,016,316	199,659	387,200	Dec. 10	1,521,639,979
422,000	Nov. 28	1,701,886,359	194,300	415,000	408,000	Dec. 13	1,560,801,782	187,000	367,048	Dec. 9	1,358,318,172
398,300	.....	1,745,776,428	199,300	.....	(c) 337,040	(o) Dec. 13	1,433,759,975	163,500	(c) 297,705	(o) Jan. 12	1,187,872,330
332,405	.....	1,727,565,353	197,200	.....	(b) 313,040	(o) Dec. 8	1,514,609,984	172,901	.....	.....	1,316,521,920
.....	Dec. 6	1,449,881,883	165,500	278,121	.....	Dec. 8	1,337,733,243	152,500	258,623	Dec. 15	1,200,506,087
187,900	Mar. 1	1,366,997,834	156,000	188,400	186,000	Oct. 15	1,379,194,095	157,442	172,600	Aug. 14	1,234,052,127
.....	July 20	1,351,590,977	154,300	251,660	.....	July	1,334,964,749	152,500	.....	.....	.....
274,000	Jan. 24	1,328,526,578	151,700	284,260	.....	Dec. 15	1,332,033,978	152,059	271,200	Dec. 16	1,230,292,597
257,700	(o) May 25	1,249,808,094	142,700	.....	251,500	Nov. 30	1,157,858,730	131,900	(n) 171,100	(n) Nov. 24	809,964,028
243,650	(o) Dec. 19	1,104,515,942	126,000	(c) 179,200	185,000	(o) Oct. 20	716,087,950	77,800	(c) 165,200	(o) Jan. 20	681,696,046
.....	Mar. 10	1,131,133,000	129,100	202,000	.....	Oct. 20	1,109,315,094	103,150	(n) 181,600	(n) Dec.22	890,509,813
285,000	Dec. 13	1,138,838,831	130,000	287,119	280,500	Dec. 15	1,118,294,193	127,555	251,375	Dec. 17	989,409,700
.....	April 16	1,095,378,000	125,000	205,000	.....	Oct. 20	975,664,102	100,323	.....	.....	.....
.....	(A) Dec.	908,579,200	103,700	194,402	.....	Nov.	858,001,300	98,000	130,403	Dec.	707,995,258
.....	Oct. 5	1,026,886,645	117,200	210,420	.....	Dec. 15	959,430,412	109,500	203,904	Dec. 4	849,064,272
225,804	Sept. 20	930,285,847	106,200	118,113	186,800	Nov. 9	809,134,896	92,600	157,332	Sept. 15	686,548,440
263,000	Dec. 22	957,946,741	109,300	265,200	259,750	Dec. 21	874,023,045	99,774	228,000	Dec. 17	783,019,562
.....	Nov. 9	936,704,222	106,900	.....	.....	.....	.....	.....	.....	.....	.....
154,044	.....	884,762,116	101,000	.....	(G) 139,809	Dec. 13	720,018,554	(G) 70,708	(d) 166,390	Dec. 9	(f) 615,092,925
.....	.....	839,375,628	95,800	181,677	172,600	Dec. 6	805,380,692	91,938	168,659	Dec. 2	742,601,203
155,453	Dec. 21	787,258,688	89,900	135,665	134,600	Dec. 20	708,450,887	80,373	131,468	Dec. 10	632,626,358
.....	Dec. 19	748,502,053	85,400	190,276	.....	Dec. 17	673,760,354	79,909	203,199	Dec. 1	648,078,358
.....	(A) Sept.	784,402,000	89,500	120,270	.....	Dec.	801,444,000	91,500	112,343	Dec.	744,186,000
165,000	Nov. 21	786,877,691	89,800	.....	(c) 162,500	Dec. 21	802,768,634	91,640	(b) 160,700	(o) Dec. 21	718,195,433
113,570	Dec. 28	633,019,740	72,260	103,783	97,500	Dec. 22	571,833,994	65,277	107,030	Oct. 30	515,523,750
129,000	Jan. 27	651,397,468	74,400	136,800	132,000	Jan. 12	653,812,207	74,636	155,000	Dec. 11	654,488,668
120,200	Dec. 9	634,248,100	72,400	(i) 120,000	(c) 114,500	June 22	631,681,400	72,100	115,000	Nov. 13	513,962,900
132,350	June 28	782,173,960	89,300	150,000	(c) 142,240	Oct. 20	937,689,159	107,000	.....	.....	.....
132,400	Dec. 21	584,279,702	66,700	121,700	120,200	Dec. 3	521,136,258	59,490	109,860	Dec. 16	479,878,822
97,580	Dec. 13	411,462,360	47,000	91,500	89,700	Dec. 1	398,348,320	45,475	.....	.....	.....
113,234	Feb. 15	574,290,447	65,600	(c) 120,667	125,000	Dec. 22	543,152,601	58,662	(i) 100,000	.....	417,368,862
120,806	(m) Dec. 15	488,156,281	55,700	79,700	(h) 73,200	(m) Oct. 19	365,170,871	43,450	(m) 71,000	Dec. 4	339,117,030
.....	.....	399,543,412	45,600	54,942	50,000	Nov. 29	207,140,920	23,630	45,000	Nov. 24	156,979,298
98,700	(o) July 27	495,593,161	56,600	.....	(b) 107,400	(o) Jan. 15	535,078,389	(g) 102,180	106,100	Dec. 2	522,063,648
120,900	Dec. 30	495,663,700	56,600	(h) 121,300	(c) 118,600	Dec. 17	476,272,500	54,200	(c) 105,500	(o) Dec. 18	421,155,600
.....	(A) Dec.	352,253,000	40,200	47,990	.....	Aug.	266,320,000	30,400	38,555	Aug.	198,959,000
81,400	(o) Dec. 19	382,228,176	43,600	77,400	77,000	May 26	350,695,351	40,118	(k) 81,500	Oct. 21	350,518,281
.....	Dec. 13	390,808,000	44,600	91,490	.....	Nov. 16	318,395,010	36,311	(b) 58,390	(o) Dec. 1	180,932,804
.....	.....	354,047,654	40,400	.....	(b) 69,870	(o) Dec. 15	286,218,156	32,766	(b) 68,270	.....	287,165,218
.....	.....	374,724,290	42,800	67,040	67,040	Dec. 6	293,010,721	32,737	(s) 67,180	Oct. 20	(t) 251,310,788
88,200	Dec. 9	409,680,096	46,700	.....	82,300	(n) Dec. 9	377,662,174	43,114	(n) 79,440	(n) Dec. 15	304,400,743
.....	(A) Oct.	362,094,000	41,340	56,000	.....	Dec.	263,299,360	30,000	39,250	Dec.	199,847,650
.....	(A) Dec.	426,426,000	48,700	(L) 95,000	.....	.....	(L) 426,399,670	(L) 48,700	46,000	Nov.	160,646,601
87,000	Feb. 15	413,209,393	47,200	(b) 88,330	90,000	Nov. 23	395,333,291	45,200	84,765	Dec. 22	341,630,292
.....	(A) Nov.	401,856,000	45,900	86,410	.....	Oct.	399,825,337	45,600	75,484	Oct.	364,574,445
98,500	Dec. 19	383,128,587	43,700	91,500	90,000	Dec. 15	350,024,224	65,068	84,000	Dec. 16	318,700,406
.....	.....	354,762,797	40,500	74,800	65,000	Oct. 6	321,816,370	36,800	71,800	July 2	317,772,280
.....	.....	250,542,000	28,600	34,000	.....	Dec.	122,937,000	14,000	.....	.....	.....
74,000	Sept. 7	305,326,889	34,850	80,070	76,790	Dec. 18	334,518,201	38,187	74,800	Dec. 8	262,971,086
.....	.....	241,723,000	27,600	.....	.....	.....	.....	.....	.....	.....	.....

Supplement to ELECTRICAL WORLD, May 18, 1929

Output and Peak Load of Largest Systems in North Americ

ublic utility, lighting, power and electric railway systems in the United States, Canada and Mexico having yea

1928			1927					1926			
Date of stantaneous System Peak (6)	Output for Year Kw.-Hr. (Including Purchased Energy) (7)	Average Load in Kw. 1928 (8)	System Peak Load Kw. (Instantaneous) (9)	System Peak Load (Est. Over Thirty-Minute Period) Kw. (10)	Date of Instantaneous System Peak (11)	Output for Year Kw.-Hr. (Including Purchased Energy) (12)	Average Load in Kw. 1927 (13)	Peak Load Kw. (Instantaneous) (14)	Peak Load (Est. Over Thirty-Minute Period) Kw. (15)	Date of Instantaneous Peak (16)	Output for Year Kw.-Hr. (17)
Dec. 19	4,832,459,513	550,000	732,400	715,100	Dec. 2	4,634,341,084	529,000	68,800	682,800	Dec. 9	4,463,911,125
Dec. 20	4,210,700,000	479,000	784,077	765,703	Dec. 13	2,877,090,621	328,300	731,964	710,714	Dec. 20	2,554,025,704
(n) Dec. 21	4,174,661,000	475,000	952,000	916,000	Dec. 8	3,778,380,000	431,300	897,000	867,000	Dec. 15	3,482,632,000
Oct. 26	2,762,459,843	314,500	448,900	.....	Dec. 9	2,421,357,098	276,300	422,700	.....	Nov. 9	2,227,879,772
Dec. 14	2,545,713,564	289,800	439,568	.....	July 29	2,322,015,035	265,100	406,970	.....	Dec. 22	2,157,886,980
Nov. 19	2,438,304,900	277,600	447,500	(a) 443,800	Dec. 20	2,142,549,100	244,500	439,000	(a) 435,000	Sept. 15	2,025,063,700
.....	2,358,032,225	268,400	.....	475,000	(n) Oct. 24	2,215,947,000	253,000	(B) 420,000	400,000	Oct. 8	1,966,393,998
Dec. 17	2,266,856,345	258,000	455,000	447,300	Dec. 19	1,860,613,091	212,400	444,000	431,500	Dec. 20	1,749,016,316
Dec. 17	1,879,024,063	213,900	435,500	422,000	Nov. 28	1,701,886,359	194,300	415,000	408,000	Dec. 13	1,560,801,782
Oct. 9	1,847,072,621	210,300	.....	398,300	.....	1,745,776,428	199,300	.....	(c) 337,040	(o) Dec. 13	1,433,759,975
.....	1,764,742,160	201,000	.....	(b) 332,405	.....	1,727,565,353	197,200	.....	(b) 313,040	(o) Dec. 8	1,514,609,984
Dec. 17	1,719,825,708	195,800	319,599	.....	Dec. 6	1,449,881,883	165,500	278,121	.....	Dec. 8	1,337,733,243
.....	1,583,985,000	180,300	191,100	187,900	Mar. 1	1,366,997,834	156,000	188,400	186,000	Oct. 15	1,379,194,095
July 25	1,537,851,047	175,100	271,665	.....	July 20	1,351,590,977	154,300	251,660	.....	July	1,334,964,749
Dec. 11	1,434,185,024	163,300	276,900	274,000	Jan. 24	1,328,526,578	151,700	284,260	.....	Dec. 15	1,332,033,978
.....	1,388,274,167	158,000	.....	(c) 257,700	(o) May 25	1,249,808,094	142,700	.....	251,500	Nov. 30	1,157,858,730
(o) Dec. 11	1,384,834,239	157,700	.....	(o) 243,650	(o) Dec. 19	1,104,515,942	126,000	(c) 179,200	185,000	(o) Oct. 20	716,087,950
Dec. 11	1,305,004,000	148,500	211,000	.....	Mar. 10	1,131,133,000	129,100	202,000	.....	Oct. 20	1,109,315,094
Oct. 23	1,282,476,855	146,000	293,731	285,000	Dec. 13	1,138,838,831	130,000	287,119	280,500	Dec. 15	1,118,294,193
Dec. 18	1,270,328,000	144,600	216,000	.....	April 16	1,095,378,000	125,000	205,000	.....	Oct. 20	975,664,102
(A) Dec.	1,176,653,000	133,900	(A) 203,002	.....	(A) Dec.	908,579,200	103,700	194,402	.....	Nov.	858,001,300
Nov. 19	1,148,886,380	130,800	229,314	.....	Oct. 5	1,026,886,645	117,200	210,420	.....	Dec. 15	959,430,412
Dec. 17	1,102,278,322	125,500	225,919	225,804	Sept. 20	930,285,847	106,200	118,113	186,800	Nov. 9	809,134,896
Dec. 20	1,076,612,618	122,600	265,000	263,000	Dec. 22	957,946,741	109,300	265,200	259,750	Dec. 21	874,023,045
Dec. 4	1,052,549,327	119,800	213,000	.....	Nov. 9	936,704,222	106,900	.....	.....	.....	.....
Dec. 13	1,047,466,830	119,200	.....	(G) 154,044	.....	884,762,116	101,000	.....	(G) 139,809	Dec. 13	720,018,554
.....	908,760,906	103,500	.....	.....	.....	839,375,628	95,800	181,677	172,600	Dec. 6	805,380,692
Dec. 20	877,953,546	100,000	158,453	155,453	Dec. 21	787,258,688	89,900	135,665	134,600	Dec. 20	708,450,887
Nov. 2	857,209,496	97,600	224,508	.....	Dec. 19	748,502,053	85,400	190,276	.....	Dec. 17	673,760,354
(A) Dec.	830,862,000	94,600	(A) 118,678	.....	(A) Sept.	784,402,000	89,500	120,270	.....	Dec.	801,444,000
o) Dec. 20	825,430,643	94,000	.....	(c) 165,000	Nov. 21	786,877,691	89,800	.....	(c) 162,500	Dec. 21	802,768,634
.....	746,709,000	85,000	128,120	113,570	Dec. 28	633,019,740	72,260	103,783	97,500	Dec. 22	571,833,994
Mar. 9	730,061,103	83,100	137,800	129,000	Jan. 27	651,397,468	74,400	136,800	132,000	Jan. 12	653,812,207
Dec. 5	655,035,700	74,600	(i) 127,000	(c) 120,200	Dec. 9	634,248,100	72,400	(i) 120,000	(c) 114,500	June 22	631,681,400
Dec. 5	645,621,149	73,500	(i) 140,000	(b) 132,350	June 28	782,173,960	89,300	150,000	(c) 142,240	Oct. 20	937,689,159
Dec. 10	639,415,709	72,800	133,300	132,400	Dec. 21	584,279,702	66,700	121,700	120,200	Dec. 3	521,136,258
Sept. 4	612,905,709	69,800	97,580	97,580	Dec. 13	411,462,360	47,000	91,500	89,700	Dec. 1	398,348,320
Oct. 23	606,647,383	69,100	.....	(b) 113,234	Feb. 15	574,290,447	65,600	(c) 120,667	125,000	Dec. 22	543,152,601
Dec. 21	584,714,544	66,600	.....	(k) 120,806	(m) Dec. 15	488,156,281	55,700	79,700	(k) 73,200	(m) Oct. 19	365,170,871
.....	567,869,411	64,600	.....	.....	.....	399,543,412	45,600	54,942	50,000	Nov. 29	207,140,920
o) Dec. 18	559,090,541	63,700	.....	(c) 98,700	(o) July 27	495,593,161	56,600	.....	(b) 107,400	(o) Jan. 15	535,078,389
(o) Jan.6	549,922,100	62,600	.....	(b) 120,900	Dec. 30	495,663,700	56,600	(k) 121,300	(c) 118,600	Dec. 17	476,272,500
June 9	528,895,495	60,200	.....	.....	.....	.....	.....	.....	.....	.....	.....
(A) Nov.	506,009,000	57,600	(A) 70,245	.....	(A) Dec.	352,253,000	40,200	47,990	.....	Aug.	266,320,000
m) Dec. 14	458,973,651	52,300	.....	(c) 81,400	(o) Dec. 19	382,228,176	43,600	77,400	77,000	May 26	350,695,351
Oct. 29	454,600,000	51,800	90,110	.....	Dec. 13	390,808,000	44,600	91,490	.....	Nov. 16	318,395,010
.....	445,804,848	50,800	.....	.....	.....	354,047,654	40,400	.....	(b) 69,870	(o) Dec. 15	286,218,156
.....	441,845,615	50,300	.....	.....	.....	374,724,290	42,800	67,040	67,040	Dec. 6	293,010,721
n) Dec. 7	440,886,606	50,200	.....	(a) 88,200	Dec. 9	409,680,096	46,700	.....	82,300	(n) Dec. 9	377,662,174
(A) Oct.	436,633,000	49,700	(A) 75,000	.....	(A) Oct.	362,094,000	41,340	56,000	.....	Dec.	263,299,360
(A) Oct.	430,427,600	49,000	(A) 101,000	.....	(A) Dec.	426,426,000	48,700	(L) 95,000	.....	.....	(L) 426,399,670
Oct. 23	429,933,355	49,000	89,500	87,000	Feb. 15	413,209,393	47,200	(b) 88,330	90,000	Nov. 23	395,333,291
(A) Aug.	416,134,000	47,400	(A) 77,950	.....	(A) Nov.	401,856,000	45,900	86,410	.....	Oct.	399,825,337
Nov. 26	413,992,663	47,100	101,000	98,500	Dec. 19	383,128,587	43,700	91,500	90,000	Dec. 15	350,024,224
Dec. 28	413,187,644	47,000	.....	.....	.....	354,762,797	40,500	74,800	65,000	Oct. 6	321,816,370
(A) Oct.	390,533,000	44,400	.....	.....	.....	250,542,000	28,600	34,000	.....	Dec.	122,937,000
(o) Dec.	383,337,429	43,600	74,100	74,000	Sept. 7	305,326,889	34,850	80,070	76,790	Dec. 18	334,518,201
(A) Oct.	381,404,000	43,400	.....	.....	.....	241,723,000	27,600	.....	.....	.....	.....

46	Indiana & Michigan Electric Company.....	46	91,560	.....	Oct. 29	454,600,000	51,800	90,110	.....	
47	The Cincinnati Gas & Power Company	47	.....	.....	.....	445,804,848	50,800	.....	.....	

t Generating and Distributing
ca

yearly output in excess of 100,000,000 kw.-hr. during 1928

Year r.	Average Load in Kw. 1926 (18)	1925 Peak Load Kw. (Instantaneous) (19)	1925 Date of Instantaneous Peak (20)	1925 Output for Year Kw.-Hr. (21)	1924 Peak Load Kw. (Instantaneous) (22)	1924 Date of Peak (23)	1924 Output for Year Kw.-Hr. (24)	1923 Peak Load Kw. (25)	1923 Date of Peak (26)	1923 Output for Year Kw.-Hr. (27)	Line No. (28)
,125	509,580										1
,704	291,555	656,312	Dec. 21	2,262,620,409	615,283	Dec. 23	2,056,432,473	555,433	Dec. 5	1,899,679,975	2
,000	398,000	809,000	Dec. 23	3,091,424,000	717,000	Dec. 19	2,787,090,000	624,000	Dec. 4	2,573,286,711	3
,772	255,004	395,900	July 22	1,987,661,654	330,660	Mar. 10	1,664,151,512	312,500	Oct. 17	1,548,896,120	4
,980	246,334	380,084	Nov. 4	2,001,474,640	343,701	Dec. 19	1,887,113,680	306,945	Dec. 12	1,725,619,492	5
,700	231,200	391,000	Oct. 2	1,732,420,700	335,800	Nov. 21	1,460,631,400	303,600	Dec.5	1,360,017,300	6
,998	224,210	291,000	Oct. 22	1,196,244,494							7
,316	199,659	387,200	Dec. 10	1,521,639,979	334,048	Dec. 22	1,313,297,283	299,438	Dec. 27	1,148,511,101	8
,782	187,000	367,048	Dec. 9	1,358,318,172	335,689	Dec. 22	1,198,240,840	282,654	Dec. 5	1,084,990,294	9
,975	163,500	(c) 297,705	(o) Jan. 12	1,187,872,330	(o) 287,000	Dec. 16	1,054,909,770	270,800	Dec. 11	1,001,026,319	10
,984	172,901			1,316,521,920			1,196,885,215			1,140,890,776	11
,243	152,500	258,623	Dec. 15	1,200,506,087							12
,095	157,442	172,600	Aug. 14	1,234,052,127	159,150	Dec. 15	1,121,245,976	156,500	July 26	1,122,750,450	13
,749	152,500										14
,978	152,059	271,200	Dec. 16	1,230,292,597	239,380	Dec. 16	1,093,939,801	219,500	Nov. 20	1,063,046,267	15
,730	131,900	(n) 171,100	(n) Nov. 24	809,964,028							16
,950	77,800	(c) 165,200	(o) Jan. 20	681,696,046	(o) 151,200	Dec. 2	562,802,440	139,314	Oct. 23	575,067,581	17
,094	103,150	(n) 181,600	(n) Dec.22	890,509,813							18
,193	127,555	251,375	Dec. 17	989,409,700	227,954	Dec. 10	865,079,266	187,275	Dec. 20	802,859,991	19
,102	100,323										20
,300	98,000	130,403	Dec.	707,995,258	135,335	Dec. 22	630,923,200	116,453	Nov.	602,691,800	21
,412	109,500	203,904	Dec. 4	849,064,272	156,179	Dec. 16	595,329,699	138,291	Nov. 27	553,624,392	22
,896	92,600	157,332	Sept. 15	686,548,440	146,789	Dec. 5	602,152,714	139,849	Sept. 18	574,031,472	23
,045	99,774	228,000	Dec. 17	783,019,562	201,600	Dec. 23	684,632,824	180,000	Dec. 20	598,808,757	24
											25
,554	(G) 70,708	(d) 166,390	Dec. 9	(f) 615,092,925	(D) 115,392	Dec. 5	(E) 514,065,402	98,017	Dec. 4	427,460,666	26
,692	91,938	168,659	Dec. 2	742,601,203	156,619	Dec. 5	691,099,810	149,196	Nov. 26	636,428,456	27
,887	80,373	131,468	Dec. 10	632,626,358	125,000	Dec. 19	607,067,218	124,300	Dec. 19	577,578,440	28
,354	79,909	203,199	Dec. 1	648,078,358	167,929	Nov. 24	564,459,887	153,123	Dec. 10	526,465,178	29
,000	91,500	112,343	Dec.	744,186,000	105,544	Dec.	749,653,000	105,452	Dec.	621,977,000	30
,634	91,640	(b) 160,700	(o) Dec. 21	718,195,433	143,500	Dec. 23	648,307,210	138,410	Dec. 19	678,346,746	31
,994	65,277	107,030	Oct. 30	515,523,750	91,824	Dec. 19	426,053,680	86,487	Nov. 9	413,240,900	32
,207	74,636	155,000	Dec. 11	654,488,668	112,500	Dec. 10	477,593,985	93,700	Mar 5	460,097,505	33
,400	72,100	115,000	Nov. 13	513,962,900	98,200	April 16	487,859,000	85,000	Jan. 3	420,028,600	34
,159	107,000										35
,258	59,490	109,860	Dec. 16	479,878,822	101,162	Dec. 22	437,209,701	98,945	Dec. 13	426,337,964	36
,320	45,475										37
,601	58,662	(i) 100,000		417,368,862	75,000		341,939,101	61,100	Jan. 19	340,864,488	38
,871	43,450	(m) 71,000	Dec. 4	339,117,030	(m) 67,723	Dec. 4	315,582,737	62,800	Sept. 27	289,903,699	39
,920	23,630	45,000	Nov. 24	156,979,298	36,456	Nov. 15	129,946,323	30,850	Dec.	108,364,544	40
,389	(g) 102,180	106,100	Dec. 2	522,063,648	121,000	Dec. 3	417,544,531	92,723	Dec.	415,424,787	41
,500	54,200	(c) 105,500	(o) Dec. 18	421,155,600	(o) 91,600	(o) Dec. 19	394,013,720	81,500	Dec. 20	365,997,750	42
											43
,000	30,400	38,555	Aug.	198,959,000	48,238	May	218,464,000	40,016	Aug.	222,590,000	44
,351	40,118	(k) 81,500	Oct. 21	350,518,281	77,000	Dec. 15	279,848,936	73,000	Dec. 5	273,643,372	45
,010	36,311	(b) 58,390	(o) Dec. 1	180,932,804	(o) 33,300	(o) Dec. 11	133,329,990	37,970	May 8	156,333,990	46
,156	32,766	(b) 68,270		287,165,218			227,558,428	50,900	Dec. 5	196,432,892	47
,721	32,737	(s) 67,180	Oct. 20	(t) 251,310,788	36,222	Dec. 10	180,554,058	32,463	Nov. 20	153,500,531	48
,174	43,114	(n) 79,440	(n) Dec. 15	304,400,743		Dec. 23	276,663,178	56,400	Dec. 18	262,940,313	49
,360	30,000	39,250	Dec.	199,847,650	33,100	Nov. 25	161,307,120	27,400	Dec. 3	129,318,120	50
,670	(L) 48,700	46,000	Nov.	160,646,601	25,000	Dec.	100,538,848				51
,291	45,200	84,765	Dec. 22	341,630,292	69,300	Dec. 16	298,707,292	57,000	Jan.	182,281,000	52
,337	45,600	75,484	Oct.	364,574,445	(o) 68,375	Sept. 29	340,181,750	50,300	May 22	251,144,646	53
,224	65,068	84,000	Dec. 16	318,700,406	77,000	Dec. 23	286,695,035	70,000	Dec. 27	269,870,850	54
,370	36,800	71,800	July 2	317,772,280	56,700	Nov. 8	238,574,255	59,600	June 13	217,138,000	55
,000	14,000										56
,201	38,187	74,800	Dec. 8	262,971,086							57

	Dec. 13	390,808,000	44,600	91,490		Nov. 16	318,395,010	36,311	(b) 58,390	(o) Dec. 1	180,932,804
		354,047,654	40,400		(b) 69,870	(o) Dec. 15	286,218,156	32,766	(b) 68,270		287,165,218

(o) Dec.	383,337,429	43,600	74,100	74,000	Sept. 7	305,326,889	34,850	80,070	76,790	Dec. 18	334,518,201							
(A) Oct.	381,404,000	43,400				241,723,000	27,600											
46	Indiana & Michigan Electric Company	46		91,560			Oct. 29	454,600,000	51,800		90,110							
47	The Connecticut Light & Power Company	47						445,804,848	50,800									
48	The California Oregon Power Company	48						441,845,615	50,300									
49	Virginia Electric & Power Company	49				95,100	(n) Dec. 7	440,886,606	50,200			(a)						
50	Houston Lighting & Power Company	50	(A)	82,600			(A) Oct.	436,633,000	49,700	(A)	75,000							
51	Carolina Power & Light Company	51	(A)	107,000			(A) Oct.	430,427,600	49,000	(A)	101,000							
52	Associated Gas & Electric System (Penna. Elec. Corp. Group)	52		84,386			Oct. 23	429,933,355	49,000		89,500							
53	Minnesota Power & Light Company	53	(A)	80,696			(A) Aug.	416,134,000	47,400	(A)	77,950							
54	Potomac Electric Power Company	54		110,500		108,000	Nov. 26	413,992,663	47,100		101,000							
55	Turners Falls Power & Electric Company	55				98,400	Dec. 28	413,187,644	47,000									
56	Louisiana Power & Light Company	56	(A)	92,553			(A) Oct.	390,533,000	44,400									
57	Central Indiana Power Company Subsidiaries	57			(c)	84,205	(o) Dec.	383,337,429	43,600		74,100							
58	Texas Electric Service Company	58	(A)	67,494			(A) Oct.	381,404,000	43,400									
59	Northern Ohio Power & Light Company	59				80,300		378,609,988	43,100									
60	Rochester Gas & Electric Corporation	60		84,900	(o)	75,290	Nov. 19	376,764,523	42,900		80,150							
61	Texas Power & Light Company	61	(A)	92,620			(A) Sept.	374,563,000	42,700	(A)	84,200							
62	Indianapolis Power & Light Company	62		76,600		76,600	Dec. 4	356,228,046	40,600									
63	St. Lawrence County Utilities, Inc.	63		61,150			June 9	341,060,000	38,800									
64	Central Illinois Public Service Company	64			(c)	66,300	(o) Nov.	339,189,800	38,600									
65	New Orleans Public Service Inc.	65	(A)	68,000			(A) Dec.	338,629,000	38,600	(A)	66,500							
66	Philadelphia Suburban-Counties Gas & Electric Company	66		67,900		54,670	April 11	319,190,403	36,300									
67	St. Lawrence Valley Power Corporation	67		48,285			Nov. 26	309,338,919	35,200									
68	Columbus Electric & Power Company and Subsidiaries	68		74,890			April 5	308,177,094	35,100		74,220							
69	City of Seattle, Light & Power Department	69		76,800		75,000	Dec. 4	307,909,700	35,050		75,000							
70	Northern Indiana Public Service Company	70				52,094		302,031,809	34,400									
71	Public Service Company of Colorado	71		67,797			Dec. 12	298,387,145	34,000			(c)						
72	Birmingham Electric Company	72	(A)	53,720			(A) Aug.	298,379,513	34,000	(A)	53,811							
73	The Southern Sierras Power Company (S)	73				51,900	(n) July 24	294,781,380	33,550		57,600							
74	Northwestern Electric Company	74	(A)	53,100			(A) Dec.	286,820,000	32,650	(A)	48,100							
75	Louisville Gas & Electric Company and Subsidiaries	75						285,767,900	32,500									
76	The Columbus Railway, Power & Light Company	76		63,000		60,000	Dec. 18	283,654,155	32,300									
77	Wisconsin Power & Light Company	77			(c)	61,532	(o) Nov.	283,520,629	32,300		(N)							
78	United Illuminating Company (U)	78			(B)	34,500	(B) Dec. 3	275,965,650	31,400									
79	Salt River Valley Water Users' Association	79		55,200			June 4	275,550,594	31,400		53,275							
80	Interstate Public Service Company	80			(c)	35,628	(o) Feb.	272,698,429	31,050		58,600							
81	Michigan Northern Power Company	81			(q)	35,236	(q) July 15	270,078,433	30,750			(q)						
82	Los Angeles Gas & Electric Corporation	82		81,500		81,500	Dec. 27	269,681,600	30,700		74,000							
83	Arkansas Power & Light Company	83						259,164,000	29,500									
84	Kansas Gas & Electric Company	84	(A)	49,900			(A) Dec.	249,717,000	28,400	(A)	44,600							
85	The Scranton Electric Company	85		52,400			Dec. 14	245,526,000	27,950		51,000							
86	Hartford Electric Light Company	86				52,500	(n) Dec. 17	242,563,000	27,600			(F)						
87	Central Maine Power Company	87		53,200		53,200	Dec. 20	240,169,182	27,400			(b)						
88	Pacific Power & Light Company	88						232,877,000	26,500	(A)	35,105							
89	Illinois Electric Power Company	89		54,190		53,000	July 3	228,660,184	26,000		53,010							
90	The Empire District Electric Company	90		55,500			Aug. 8	226,034,240	25,700			(c)						
91	Public Service Company of Oklahoma	91			(c)	46,000	(o) Oct.	224,426,315	25,550	(i)	39,222							
92	U. S. Government (Muscle Shoals)	92		130,000		120,600	Feb. 14	222,096,800	25,300		125,540							
93	Nebraska Power Company	93	(A)	47,000			(A) Sept.	219,813,000	25,000	(A)	41,900							
94	Penn Central Light & Power Company	94		45,950		45,800	Oct. 30	213,808,418	24,300									
95	Central Hudson Gas & Electric Corporation	95		55,000		53,000	Nov.2	213,612,676	24,300			(o)						
96	City of Tacoma, Light Division, Dept. Pub. Util	96		49,000		49,000	Dec. 19	208,399,465	23,700		61,500							
97	Florida Power & Light Company	97	(A)	60,708			(A) Jan.	199,322,000	22,700	(A)	65,364							
98	Kentucky & West Virginia Power Company	98		11,000			July 9	194,912,000	22,200		9,800							
99	Kentucky Utilities Company	99			(c)	39,910	(o) July	194,822,819	22,200		45,800							
100	Gulf States Utilities Company	100		42,380		35,204	S. 5; (n) D. 20	191,081,273	21,750		29,754							
101	Illinois Power & Light Corporation (Southern Group)	101				43,000		187,171,597	21,300									
102	City of Cleveland, Division of Light & Power	102		37,200			Dec. 21	186,242,950	21,200		33,700							
103	Illinois Power & Light Corporation (Central Group)	103				43,000	Dec. 21	184,066,909	20,950									
104	Blackstone Valley Gas & Electric Company	104			(c)	54,970	(o) Dec. 20	182,918,142	20,800			(c)						
105	Dallas Power & Light Company	105	(A)	46,400			(A) Dec.21	179,165,000	20,400	(A)	44,300							
106	Long Island Lighting Company System	106		54,935		50,000	Dec. 29	172,923,000	19,700									
107	Memphis Power & Light Company	107	(A)	41,261			(A) Dec.	172,781,000	19,670	(A)	46,000							
108	Westchester Lighting Company	108		45,200		45,150	Dec. 24	171,315,819	19,500	(See The New Yo								
109	New Bedford Gas & Edison Light Company	109		58,800		56,000	Dec. 20	167,613,529	19,080		50,500							
110	Des Moines Electric Light Company	110				36,000		159,666,072	18,180		40,000							
111	Central Illinois Light Company	111		(K)		(K)	(K)	156,467,174	17,810		31,727							
112	San Diego Consolidated Gas & Electric Company	112						153,825,600	17,500									
113	Indiana Service Corporation	113		45,000		40,000	Dec. 17	152,957,600	17,400		34,000							
114	Tampa Electric Company and Subsidiaries	114		31,720			Sept. 21	152,885,453	17,400		25,340							
115	Moline-Rock Island Manufacturing Company	115		35,030		34,750	Oct. 17	151,902,906	17,300		31,570							
116	Wisconsin Public Service Corporation	116						149,811,913	17,060									
117	Broad River Power Company (W)*	117	(i)	60,000	(b)	54,800	Dec. 31	148,932,217	16,950									
118	Atlantic City Electric Company	118		41,500			Aug. 28	148,331,000	16,900		36,000							
119	West Texas Utilities Company	119			(c)	44,220	(o) Dec.	147,963,154	16,840									
120	Fort Worth Power & Light Company	120	(A)	39,800			(A) Aug.	146,749,000	16,700	(A)	48,500							
121	Central Power & Light Company	121			(c)	34,845	(o) Nov.	146,744,975	16,700									
122	Edison Electric Company of Lancaster, Pa.	122	(A)	32,060			(A) Dec	143,646,000	16,340	(A)	30,200							
123	Terre Haute, Indianapolis & Eastern Traction Company	123						135,476,900	15,400									
124	The Worcester Electric Light Company	124		36,900		36,300	Dec. 20	123,928,368	14,100		35,000							
125	Indiana General Service Company	125		26,480			Mar. 13	122,579,000	13,950		24,600							
126	Delaware Electric Power Company	126		24,500		23,500	Jan.4	122,337,055	13,930			(e)						
127	Southwestern Gas & Electric Company	127			(c)	31,790	(o) Nov.	119,647,273	13,600									
128	Staten Island Edison Corporation	128		32,600		28,100	Nov. 26	117,999,180	13,430		29,000	(c)						
129	Cumberland County Power & Light Company	129		31,380		30,200	Dec. 17	114,835,060	13,070									
130	New York-Pennsylvania Power System (P)	130	(i)	32,000	(b)	30,101	Dec. 19	112,741,794	12,830									
131	Salem Electric Lighting Company	131		30,500		30,500	Dec. 3	112,097,459	12,760		27,000							
132	Kansas Power & Light Company	132				30,750		108,519,670	12,350									
133	Fall River Electric Light Company	133		28,800		28,400	Dec. 30	108,444,279	12,340		30,500							
134	United Electric Light Company (Springfield, Mass.)	134		39,500		39,500	Oct. 10	108,016,994	12,300		36,800							
135	Wheeling Electric Company	135						104,830,000	11,930									
Oct. 29	454,600,000	51,800	90,110		Dec. 13	390,808,000	44,600	91,490		Nov. 16	318,395,010							

8,201		38,187		74,800	Dec. 8	262,971,086												56	
																		57	
			Dec. 13	390,808,000	44,600	91,490			Nov. 16	318,395,010		36,311	(b)	58,390	(o) Dec. 1	180,932,804
				354,047,654	40,400		(b)	69,870	(o) Dec. 15	286,218,156		32,766	(b)	68,270		287,165,218
				374,724,290	42,800	67,040		67,040	Dec. 6	293,010,721		32,737	(s)	67,180	Oct. 20	(t) 251,310,788
a)	88,200		Dec. 9	409,680,096	46,700			82,300	(n) Dec. 9	377,662,174		43,114	(n)	79,440	(n) Dec. 15	304,400,743
			(A) Oct.	362,094,000	41,340	56,000			Dec.	263,299,360		30,000		39,250	Dec.	199,847,650
			(A) Dec.	426,426,000	48,700	(L) 95,000				(L) 426,399,670	(L)	48,700		46,000	Nov.	160,646,601
		87,000	Feb. 15	413,209,393	47,200	(b) 88,330		90,000	Nov. 23	395,333,291		45,200		84,765	Dec. 22	341,630,292
			(A) Nov.	401,856,000	45,900	86,410			Oct.	399,825,337		45,600		75,484	Oct.	364,574,445
		98,500	Dec. 19	383,128,587	43,700	91,500		90,000	Dec. 15	350,024,224		65,068		84,000	Dec. 16	318,700,406
				354,762,797	40,500	74,800		65,000	Oct. 6	321,816,370		36,800		71,800	July 2	317,772,280
				250,542,000	28,600	34,000			Dec.	122,937,000		14,000				
		74,000	Sept. 7	305,326,889	34,850	80,070		76,790	Dec. 18	334,518,201		38,187		74,800	Dec. 8	262,971,086
				241,723,000	27,600											
		79,740		379,630,884	43,300			45,500		356,040,480		38,745	(n)	43,400	(n) Jan. 27	304,116,466
		71,670	Nov. 28	352,809,582	40,300	77,680	(c)	69,100	Dec. 1	326,148,706		37,232		72,070	Dec. 21	296,678,980
			(A) Sept. 14	355,707,000	40,600	76,300			Dec.	339,468,000		38,800		57,830	Sept.	264,399,000
		63,500		328,712,384	37,500											
		72,600	(n) Dec. 6	301,548,168	34,400			74,600	(n) Dec. 21	278,626,089		31,750		65,000	Nov. 18	247,311,779
			(A) Oct.	319,842,000	36,500	66,000			Dec.	222,927,000	(X)	32,100		65,000	Dec.	252,735,540
		73,000	May 25	260,726,212	29,760	69,540		68,000	June 23	257,540,000		29,400		52,040	Nov. 4	204,811,845
		75,000	Dec. 9	277,591,025	31,690	64,800		60,000	Dec. 14	232,848,275		26,581		59,600	Dec. 29	218,245,955
		44,990	Nov. 30	271,440,543	30,990			44,750	Dec. 8	227,490,211		25,969		32,796	Dec. 22	170,852,665
c)	63,980			285,892,553	32,600	67,080		66,000	Dec. 14	268,618,910		30,700		58,645	Dec. 22	244,055,345
			(A) Dec.	289,073,000	33,000	41,692			Oct.	200,750,534		22,900		35,919	Dec.	224,109,869
			July 13	279,334,470	31,900	50,200			June 30-July 1 & 2	273,230,332		31,191		49,900	July 16	260,300,146
			(A) Dec.	255,766,000	29,200	44,400			Dec.	237,403,000		27,100		39,300	Dec.	196,911,795
				234,238,160	26,750					222,310,255		25,350		56,250	Dec. 8	217,377,475
		55,100	Dec. 8	254,843,000	29,100											
	(N)		(N)	275,376,599	31,400	62,000		60,000	Dec. 7	258,765,399		29,500				
				222,132,700	25,350	31,000		30,600	Nov.	115,535,700		26,000				
			Aug. 24	206,356,017	23,550	24,750			Sept. 3	113,107,669		(z)				
		46,880	Oct. 20	(v) 237,227,562	27,050	57,800			Nov. 4	(v) 243,812,849	(v)	27,850				
q)	35,958		(q) Dec. 8	271,701,688	31,000					150,060,345		24,666	(q)	33,084	(q) Aug. 22	252,186,396
	74,000		Dec. 21	247,191,413	28,200	68,200		68,200	Dec. 23	213,459,806		24,361		58,300	Dec. 17	184,683,172
				183,843,000	21,000	43,500			Dec.	151,908,790		17,300				
			(A) Dec.	221,118,000	25,200	44,400			Dec.	194,417,500		22,200		35,800	Dec.	177,590,205
			Feb. 15	237,512,000	27,100	54,020			Nov. 22	214,065,156		18,371		46,300	Aug. 6	197,864,435
F)	51,300		Feb. 17	220,324,000	25,100	67,000	(Y)	67,000	Aug. 26	192,253,000		26,000		56,400	May 1	190,355,000
b)	48,600		(o) Dec. 16	220,727,440	25,175		(c)	43,800	(o) Dec. 17	183,268,485		20,921	(q)	628,410	Dec. 30	174,943,570
			(A) Dec.	171,611,000	19,590	27,677			Dec.	166,214,470		19,000	(i)	35,000	Aug.	155,585,700
		52,000	Dec. 7	213,752,872	24,400	43,000		42,000	Aug. 20	165,088,310		19,400				
c)	61,000		(o) Aug. 31	262,409,515	29,950	62,280		62,000	Nov. 23	214,669,321		24,730	(u)	59,260	Jan. 1	178,047,090
		35,300	Dec. 8	135,199,859	15,440											
		120,185	Nov. 29	565,609,500	64,600	106,400		102,500	Nov. 11	439,380,300		50,157				
			(A) Dec. 21	201,094,000	22,950	38,800			Sept. 22	187,052,800		21,350		30,500	Oct.	177,233,500
		45,000		226,892,235	25,900	62,500		62,450	Nov. 30	227,630,419		25,668		46,300	Dec. 14	208,994,395
o)	52,900		(o) Dec. 15	222,368,156	24,240											
		61,500	Dec. 30	197,580,149	22,500	55,000		40,300	Oct. 11	195,791,000		22,000		33,000	Dec. 29	157,662,360
			(A) Jan. 12	214,167,000	24,450	64,000			Feb.	173,623,725		19,900				
			Aug. 8	168,960,000	19,280	10,000			April 13	137,256,705		4,679				
		44,000	Dec. 5	185,904,592	21,200	(i) 34,100	(i)	34,100	(i) Dec. 21	146,560,259		16,700				
		27,500	July 20	155,783,691	17,780	(i) 22,000		20,000	(l) Dec. 2	100,344,073		11,455				
		33,700	Dec. 19	174,146,677	19,900					164,932,820		18,800	(n)	31,000	Dec. 21	151,475,140
c)	52,200		(o) Dec. 7	165,318,271	18,870		(b)	51,792	(o) Nov. 30	153,976,958		17,577		48,000	Dec. 21	138,876,295
			(A) Dec. 23	171,925,970	19,620	35,100			Nov.	159,430,750		18,200		36,400	Dec.	144,739,430
			(A) Dec.	166,244,000	18,980	36,392			Dec.	137,786,000		15,700		34,300	Dec.	121,627,000
v	York Edis	on and Allied	Companies)			32,980		32,430	Dec. 15	126,197,021		14,445		30,000	Dec. 21	104,207,060
	48,000		Jan. 4	173,617,378	19,800	52,600		50,000	Dec. 20	172,222,651		19,860		50,300	Dec. 1	155,470,630
	36,400			134,416,934	15,340	32,000		31,000	Nov. 8	128,293,150		13,800				
		29,500	Dec. 15	135,692,265	15,490	28,600		27,500	Dec. 21	117,679,234		13,000		25,800	Sept. 30	106,992,460
				126,801,100	14,480	31,900		31,000	Nov. 1	123,369,160		13,400		27,300	Dec. 18	117,956,180
		34,000	Nov. 30	131,861,909	15,030	32,900		31,500	Dec. 13	123,632,339		14,110				
			Jan. 1	114,195,401	13,030			27,620	Dec. 7	100,462,550		11,468				
		31,000	Nov. 28	131,017,494	14,950	32,530		32,000	Sept. 14	124,713,651		14,237		30,000	Dec. 4	108,316,060
				153,364,676	17,500		(c)	33,200	(o) Nov. 17	150,635,115		29,067		30,400	Dec. 4	(w) 128,835,190
			Sept. 3	157,892,000	18,000	29,000			Sept. 4	106,141,300		12,111				
			(A) April	140,230,159	16,000	51,500			Dec.	155,794,457		17,800		51,500	Dec.	183,622,520
		25,205		120,521,353	13,760											
			(A) May 19	135,474,100	15,470		(c)	28,850		125,911,263		14,373	(x)	30,300	(y)	118,617,000
		34,500	Dec. 13	112,890,480	12,880	32,500		30,000	Dec. 13	105,039,000		11,991		38,900	Feb. 4	108,822,300
			Nov. 20	105,634,000	12,060	23,140			Dec. 8	104,648,573		11,644				
e)	25,000		(o) Dec. 21	109,786,578	12,530	22,500			Aug. 13	111,341,210		11,263				
c)	25,600		Feb. 16	107,715,140	12,290	31,500	(c)	30,000	Feb. 19 & 23	100,957,540		11,525				
	30,580			116,194,720	13,260			29,740		107,971,800		12,325				
		27,000	Dec. 16	115,393,187	13,170	26,600			Dec. 28	100,874,562		11,515				
			Nov. 28	108,254,302	12,360											
		36,800	Sept. 20	101,315,500	11,570	35,830			Jan. 18	109,818,700		12,538				
10		36,311	(b)	58,390	(o) Dec. 1	180,932,804	(o)	33,300	(o) Dec. 11	133,329,990		37,970	May 8		156,333,990	46
56		32,766	(b)	68,270		287,165,218				227,558,428		50,900	Dec. 5		196,432,892	47

132	Kansas Power & Light Company	132																
133	Fall River Electric Light Company	133	28,800	28,400	Dec. 30	108,444,279	12,340	30,500										
134	United Electric Light Company (Springfield, Mass.)	134	39,500	39,500	Oct. 10	108,016,994	12,300	36,800										
135	Wheeling Electric Company	135				104,830,000	11,930											

Oct. 29	454,600,000	51,800	90,110			Dec. 13	390,808,000	44,600	91,490			Nov. 16	318,395,010					
	445,804,848	50,800					354,047,654	40,400		(b)	69,870	(o) Dec. 15	286,218,156					
	441,845,615	50,300					374,724,290	42,800	67,040		67,040	Dec. 6	293,010,721					
n) Dec. 7	440,886,606	50,200		(a)	88,200	Dec. 9	409,680,096	46,700			82,300	(n) Dec. 9	377,662,174					
(A) Oct.	436,633,000	49,700	(A) 75,000			(A) Oct.	362,094,000	41,340	56,000			Dec.	263,299,360					
(A) Oct.	430,427,600	49,000	(A) 101,000			(A) Dec.	426,426,000	48,700	(L) 95,000					(L)	426,399,670	(L)		
Oct. 23	429,933,355	49,000	89,500		87,000	Feb. 15	413,209,393	47,200	(b) 88,330		90,000	Nov. 23	395,333,291					
(A) Aug.	416,134,000	47,400	(A) 77,950			(A) Nov.	401,856,000	45,900	86,410			Oct.	399,825,337					
Nov. 26	413,992,663	47,100	101,000		98,500	Dec. 19	383,128,587	43,700	91,500		90,000	Dec. 15	350,024,224					
Dec. 28	413,187,644	47,000					354,762,797	40,500	74,800		65,000	Oct. 6	321,816,370					
(A) Oct.	390,533,000	44,400					250,542,000	28,600	34,000			Dec.	122,937,000					
(o) Dec.	383,337,429	43,600	74,100		74,000	Sept. 7	305,326,889	34,850	80,070		76,790	Dec. 18	334,518,201					
(A) Oct.	381,404,000	43,400					241,723,000	27,600										
	378,609,988	43,100			79,740		379,630,884	43,300			45,500		356,040,480					
Nov. 19	376,764,523	42,900	80,150		71,670	Nov. 28	352,809,582	40,300	77,680	(c)	69,100	Dec. 1	326,148,706					
A) Sept.	374,563,000	42,700	(A) 84,200			(A) Sept. 14	355,707,000	40,600	76,300			Dec.	339,468,000					
Dec. 4	356,228,046	40,600			63,500		328,712,384	37,500										
June 9	341,060,000	38,800																
o) Nov.	339,189,800	38,600			72,600	(n) Dec. 6	301,548,168	34,400			74,600	(n) Dec. 21	278,626,089					
A) Dec.	338,629,000	38,600	(A) 66,500			(A) Oct.	319,842,000	36,500	66,000			Dec.	222,927,000	(X)				
April 11	319,190,403	36,300																
Nov. 26	309,338,919	35,200																
April 5	308,177,094	35,100	74,220		73,000	May 25	260,726,212	29,760	69,540		68,000	June 23	257,540,000					
Dec. 4	307,909,700	35,050	75,000		75,000	Dec. 9	277,591,025	31,690	64,800		60,000	Dec. 14	232,848,275					
	302,031,809	34,400			44,990	Nov. 30	271,440,543	30,990			44,750	Dec. 8	227,490,211					
Dec. 12	298,387,145	34,000		(c)	63,980		285,892,553	32,600	67,080		66,000	Dec. 14	268,618,910					
A) Aug.	298,379,513	34,000	(A) 53,811			(A) Dec.	289,073,000	33,000	41,692			Oct.	200,750,534					
) July 24	294,781,380	33,550	57,600			July 13	279,334,470	31,900	50,200			June 30-July 1 & 2	273,230,332					
A) Dec.	286,820,000	32,650	(A) 48,100			(A) Dec.	255,766,000	29,200	44,400			Dec.	237,403,000					
	285,767,900	32,500					234,238,160	26,750					222,310,255					
Dec. 18	283,654,155	32,300			55,100	Dec. 8	254,843,000	29,100										
(o) Nov.	283,520,629	32,300	(N)		(N)	(N)	275,376,599	31,400	62,000		60,000	Dec. 7	258,765,399					
B) Dec. 3	275,965,650	31,400					222,132,700	25,350	31,000		30,600	Nov.	115,535,700					
June 4	275,550,594	31,400	53,275			Aug. 24	206,356,017	23,550	24,750			Sept. 3	113,107,669					
(o) Feb.	272,698,429	31,050	58,600		46,880	Oct. 20	(v) 237,227,562	27,050	57,800			Nov. 4	(v) 243,812,849	(v)				
) July 15	270,078,433	30,750		(q)	35,958	(q) Dec. 8	271,701,688	31,000					150,060,345					
Dec. 27	269,681,600	30,700	74,000		74,000	Dec. 21	247,191,413	28,200	68,200		68,200	Dec. 23	213,459,806					
	259,164,000	29,500					183,843,000	21,000	43,500			Dec.	151,908,790					
A) Dec.	249,717,000	28,400	(A) 44,600			(A) Dec.	221,118,000	25,200	44,400			Dec.	194,417,500					
Dec. 14	245,526,000	27,950	51,000			Feb. 15	237,512,000	27,100	54,020			Nov. 22	214,065,156					
n) Dec. 17	242,563,000	27,600		(F)	51,300	Feb. 17	220,324,000	25,100	67,000	(Y)	67,000	Aug. 26	192,253,000					
Dec. 20	240,169,182	27,400		(b)	48,600	(o) Dec. 16	220,727,440	25,175		(c)	43,800	(o) Dec. 17	183,268,485					
	232,877,000	26,500	(A) 35,105			(A) Dec.	171,611,000	19,590	27,677			Dec.	166,214,470					
July 3	228,660,184	26,000	53,010		52,000	Dec. 7	213,752,872	24,400	43,000		42,000	Aug. 20	165,088,310					
Aug. 8	226,034,240	25,700		(c)	61,000	(o) Aug. 31	262,409,515	29,950	62,280		62,000	Nov. 23	214,669,321					
(o) Oct.	224,426,315	25,550	(i) 39,222		35,300	Dec. 8	135,199,859	15,440										
Feb. 14	222,096,800	25,300	125,540		120,185	Nov. 29	565,609,500	64,600	106,400		102,500	Nov. 11	439,380,300					
A) Sept.	219,813,000	25,000	(A) 41,900			(A) Dec. 21	201,094,000	22,950	38,800			Sept. 22	187,052,800					
Oct. 30	213,808,418	24,300			45,000		226,892,235	25,900	62,500		62,450	Nov. 30	227,630,419					
Nov.2	213,612,676	24,300		(o)	52,900	(o) Dec. 15	222,368,156	24,240										
Dec. 19	208,399,465	23,700	61,500		61,500	Dec. 30	197,580,149	22,500	55,000		40,300	Oct. 11	195,791,000					
(A) Jan.	199,322,000	22,700	(A) 65,364			(A) Jan. 12	214,167,000	24,450	64,000			Feb.	173,623,725					
July 9	194,912,000	22,200	9,800			Aug. 8	168,960,000	19,280	10,000			April 13	137,256,705					
(o) July	194,822,819	22,200	45,800		44,000	Dec. 5	185,904,592	21,200	(i) 34,100	(i)	34,100	(i) Dec. 21	146,560,259					
5; (n) D. 20	191,081,273	21,750	29,754		27,500	July 20	155,783,691	17,780	(i) 22,000		20,000	(l) Dec. 2	100,344,073					
	187,171,597	21,300																
Dec. 21	186,242,950	21,200	33,700		33,700	Dec. 19	174,146,677	19,900					164,932,820					
Dec. 21	184,066,909	20,950																
) Dec. 20	182,918,142	20,800		(c)	52,200	(o) Dec. 7	165,318,271	18,870		(b)	51,792	(o) Nov. 30	153,976,958					
A) Dec.21	179,165,000	20,400	(A) 44,300			(A) Dec. 23	171,925,970	19,620	35,100			Nov.	159,430,750					
Dec. 29	172,923,000	19,700																
A) Dec.	172,781,000	19,670	(A) 46,000			(A) Dec.	166,244,000	18,980	36,392			Dec.	137,786,000					
Dec. 24	171,315,819	19,500	(See The New York Edison and Allied Companies)						32,980		32,430	Dec. 15	126,197,021					
Dec. 20	167,613,529	19,080	50,500		48,000	Jan. 4	173,617,378	19,800	52,600		50,000	Dec. 20	172,222,651					
	159,666,072	18,180	40,000		36,400		134,416,934	15,340	32,000		31,000	Nov. 8	128,293,150					
(K)	156,467,174	17,810	31,727		29,500	Dec. 15	135,692,265	15,490	28,600		27,500	Dec. 21	117,679,234					
	153,825,600	17,500					126,801,100	14,480	31,900		31,000	Nov. 1	123,369,160					
Dec. 17	152,957,600	17,400	34,000		34,000	Nov. 30	131,861,909	15,030	32,900		31,500	Dec. 13	123,632,339					
Sept. 21	152,885,453	17,400	25,340			Jan. 1	114,195,401	13,030			27,620	Dec. 7	100,462,550					
Oct. 17	151,902,906	17,300	31,570		31,000	Nov. 28	131,017,494	14,950	32,530		32,000	Sept. 14	124,713,651					
	149,811,913	17,060					153,364,676	17,500		(c)	33,200	(o) Nov. 17	150,635,115					
Dec. 31	148,932,217	16,950																
Aug. 28	148,331,000	16,900	36,000			Sept. 3	157,892,000	18,000	29,000			Sept. 4	106,141,300					
(o) Dec.	147,963,154	16,840																
A) Aug.	146,749,000	16,700	(A) 48,500			(A) April	140,230,159	16,000	51,500			Dec.	155,794,457					
(o) Nov.	146,744,975	16,700			25,205		120,521,353	13,760										
A) Dec	143,646,000	16,340	(A) 30,200			(A) May 19	135,474,100	15,470		(c)	28,850		125,911,263					
	135,476,900	15,400																
Dec. 20	123,928,368	14,100	35,000		34,500	Dec. 13	112,890,480	12,880	32,500		30,000	Dec. 13	105,039,000					
Mar. 13	122,579,000	13,950	24,600			Nov. 20	105,634,000	12,060	23,140			Dec. 8	104,648,573					
Jan.4	122,337,055	13,930		(e)	25,000	(o) Dec. 21	109,786,578	12,530	22,500			Aug. 13	111,341,210					
(o) Nov.	119,647,273	13,600																
Nov. 26	117,999,180	13,430	29,000	(c)	25,600	Feb. 16	107,715,140	12,290	31,500	(c)	30,000	Feb. 19 & 23	100,957,540					
Dec. 17	114,835,060	13,070			30,580		116,194,720	13,260			29,740		107,971,800					
Dec. 19	112,741,794	12,830																
Dec. 3	112,097,459	12,760	27,000		27,000	Dec. 16	115,393,187	13,170	26,600			Dec. 28	100,874,562					
	108,519,670	12,350																
Dec. 30	108,444,279	12,340	30,500			Nov. 28	108,254,302	12,360										
Oct. 10	108,016,994	12,300	36,800		36,800	Sept. 20	101,315,500	11,570	35,830			Jan. 18	109,818,700					
	104,830,000	11,930																

109	New Bedford Gas & Edison Light Company	109	58,800	56,000	Dec. 20	167,613,529	19,080	50,500										
110	Des Moines Electric Light Company	110		36,000		159,666,072	18,180	40,000										

36,800		Sept. 20	101,315,500	11,570		35,830		Jan. 18	109,818,700	12,538					
010	36,311	(b)	58,390	(o) Dec. 1	180,932,804	(o)	33,300	(o) Dec. 11	133,329,990	37,970	May 8	156,333,990	46
156	32,766	(b)	68,270		287,165,218				227,558,428	50,900	Dec. 5	196,432,892	47
721	32,737	(s)	67,180	Oct. 20	(t) 251,310,788		36,222	Dec. 10	180,554,058	32,463	Nov. 20	153,500,531	48
174	43,114	(n)	79,440	(n) Dec. 15	304,400,743			Dec. 23	276,663,178	56,400	Dec. 18	262,940,313	49
360	30,000		39,250	Dec.	199,847,650		33,100	Nov. 25	161,307,120	27,400	Dec. 3	129,318,120	50
670	(L) 48,700		46,000	Nov.	160,646,601		25,000	Dec.	100,538,848				51
291	45,200		84,765	Dec. 22	341,630,292		69,300	Dec. 16	298,707,292	57,000	Jan.	182,281,000	52
337	45,600		75,484	Oct.	364,574,445	(o)	68,375	Sept. 29	340,181,750	50,300	May 22	251,144,646	53
224	65,068		84,000	Dec. 16	318,700,406		77,000	Dec. 23	286,695,035	70,000	Dec. 27	269,870,850	54
370	36,800		71,800	July 2	317,772,280		56,700	Nov. 8	238,574,255	59,600	June 13	217,138,000	55
000	14,000												56
201	38,187		74,800	Dec. 8	262,971,086								57
													58
480	38,745	(n)	43,400	(n) Jan. 27	304,116,460	(n)	47,400	Jan. 9	267,074,055	46,400	Dec. 10	259,720,216	59
706	37,232		72,070	Dec. 21	296,678,980		62,069	Dec. 12	267,223,754	61,824	Dec. 6	248,156,900	60
000	38,800		57,830	Sept.	264,399,000		53,400	Sept. 4	262,187,000	37,570	Dec. 17	225,453,000	61
													62
													63
089	31,750		65,000	Nov. 18	247,311,779		53,500	Dec. 30	202,871,998	42,300	Sept. 5	174,670,219	64
000	(X) 32,100		65,000	Dec.	252,735,540		56,000	Dec. 12	226,584,380	51,700	Dec.	211,765,420	65
													66
													67
000	29,400		52,040	Nov. 4	204,811,841		38,910	Dec. 5	156,732,805	36,310	Oct. 16	160,246,106	68
275	26,581		59,600	Dec. 29	218,245,950		50,800	Dec. 9	152,125,000	35,600	Dec. 7	115,431,550	69
211	25,969		32,796	Dec. 22	170,852,661		28,800	Dec. 23	149,220,978				70
910	30,700		58,645	Dec. 22	244,055,341		55,000	Dec. 22	216,151,037			145,302,874	71
534	22,900		35,919	Dec.	224,109,866		37,749	Dec. 10	193,987,141	35,202	Dec. 5	162,443 207	72
832	31,191		49,900	July 16	260,300,140		40,500	June 7-Oct. 21	226,680,958	40,100	June 11	219,653,900	73
000	27,100		39,300	Dec.	196,911,791	(B)	34,500		188,771,500	30,900	Dec. 19	152,702,800	74
255	25,350		56,250	Dec. 8	217,377,479		48,700	Dec. 23	168,403,952	40,650	Dec. 5	143,749,060	75
													76
399	29,500												77
700	26,000												78
669	(e)												79
849	(v) 27,850												80
845	24,666	(q)	33,084	(q) Aug. 22	252,186,398	(q)	30,297	(q) Dec. 9	258,750,604	34,510	Oct. 19	261,577,017	81
806	24,361		58,300	Dec. 17	184,683,171		69,000	Nov. 5	245,047,430	43,500	Dec. 18	127,357,201	82
790	17,300												83
500	22,200		35,800	Dec.	177,590,200		35,200	Dec.	163,783,700	33,000	Dec. 3	160,464,200	84
156	18,371		46,300	Aug. 6	197,864,432	(n)	39,800	Dec. 23	164,162,797				85
000	26,000		56,400	May 1	190,355,000		54,700	Nov. 19	163,178,438	60,200	Oct. 23 / Nov. 22	181,202,880	86
485	20,921	(q)	628,410	Dec. 30	174,943,577	(o)	33,300		154,117,396	32,200	Dec. 3	146,136,310	87
470	19,000	(i)	35,000	Aug.	155,585,707				137,304,890	25,000	Sept.	116,676,395	88
810	19,400												89
321	24,730	(u)	59,260	Jan. 1	178,047,098		41,200	Dec. 17	148,402,996	58,826	May	152,681,540	90
													91
300	50,157												92
800	21,350		30,500	Oct.	177,233,500		34,700	Dec. 18	166,110,700	34,000	Dec. 19	160,624,600	93
419	25,668		46,300	Dec. 14	208,994,394		40,100	Dec. 30	165,364,793	36,100	Dec. 20	147,423,930	94
													95
000	22,000		33,000	Dec. 29	157,662,360		33,400	Dec. 19	147,218,203	29,600	Dec. 7	136,757,822	96
725	19,900												97
705	4,679												98
259	16,700												99
073	11,455												100
													101
820	18,800	(n)	31,000	Dec. 21	151,475,140								102
													103
958	17,577		48,000	Dec. 21	138,876,293	(o)	41,440	Dec. 18	124,813,962	40,060	Dec. 10	126,621,397	104
750	18,200		36,400	Dec.	144,739,433		31,700	Dec. 22	127,924,350	16,300	Dec. 3	105,400,728	105
													106
000	15,700		34,300	Dec.	121,627,000		31,700	Dec. 22	112,743,000				107
021	14,445		30,000	Dec. 21	104,207,062								108
651	19,860		50,300	Dec. 1	155,470,639		48,800	Dec. 22	121,512,151	47,782	Jan. 3	133,707,946	109
150	13,800												110
234	13,000		25,800	Sept. 30	106,992,465								111
160	13,400		27,300	Dec. 18	117,956,180								112
339	14,110												113
550	11,468												114
651	14,237		30,000	Dec. 4	108,316,069								115
115	29,067		30,400	Dec. 4	(w) 128,835,193		35,000	Dec.	113,239,516				116
													117
300	12,111												118
													119
457	17,800		51,500	Dec.	183,622,525		50,000	Dec. 31	257,757,000	45,067	Dec. 18	240,662,700	120
													121
263	14,373	(x)	30,300	(y)	178,617,000	(B)	26,400	Dec. 10	107,440,900	24,600	Nov. 27	100,205,700	122
													123
000	11,991		38,900	Feb. 4	108,822,300								124
573	11,644												125
210	11,263												126
													127
540	11,525												128
800	12,325												129
													130
562	11,515												131
													132
													133
700	12,538												134
													135
	48,000		Jan. 4	173,617,378	19,800		52,600	50,000	Dec. 20	172,222,651	19,860	50,300	Dec. 1	155,47
	36,400			134,416,934	15,340		32,000	31,000	Nov. 8	128,293,150	13,800			

	108,519,670	12,350												
Dec. 30	108,444,279	12,340	30,500		Nov. 28	108,254,302	12,360							
Oct. 10	108,016,994	12,300	36,800	36,800	Sept. 20	101,315,500	11,570	35,830		Jan. 18	109,818,700			
	104,830,000	11,930												

109	New Bedford Gas & Edison Light Company	109		58,800		56,000	Dec. 20	167,613,529		19,080		50,500		
110	Des Moines Electric Light Company	110				36,000		159,666,072		18,180		40,000		
111	Central Illinois Light Company	111		(K)		(K)	(K)	156,467,174		17,810		31,727		
112	San Diego Consolidated Gas & Electric Company	112						153,825,600		17,500				
113	Indiana Service Corporation	113		45,000		40,000	Dec. 17	152,957,600		17,400		34,000		
114	Tampa Electric Company and Subsidiaries	114		31,720			Sept. 21	152,885,453		17,400		25,340		
115	Moline-Rock Island Manufacturing Company	115		35,030		34,750	Oct. 17	151,902,906		17,300		31,570		
116	Wisconsin Public Service Corporation	116						149,811,913		17,060				
117	Broad River Power Company (W)*	117	(i)	60,000	(b)	54,800	Dec. 31	148,932,217		16,950				
118	Atlantic City Electric Company	118		41,500			Aug. 28	148,331,000		16,900		36,000		
119	West Texas Utilities Company	119			(c)	44,220	(o) Dec.	147,963,154		16,840				
120	Fort Worth Power & Light Company	120	(A)	39,800			(A) Aug.	146,749,000		16,700	(A)	48,500		
121	Central Power & Light Company	121			(c)	34,845	(o) Nov.	146,744,975		16,700				
122	Edison Electric Company of Lancaster, Pa.	122	(A)	32,060			(A) Dec.	143,646,000		16,340	(A)	30,200		
123	Terre Haute, Indianapolis & Eastern Traction Company	123						135,476,900		15,400				
124	The Worcester Electric Light Company	124		36,900		36,300	Dec. 20	123,928,368		14,100		35,000		
125	Indiana General Service Company	125		26,480			Mar. 13	122,579,000		13,950		24,600		
126	Delaware Electric Power Company	126		24,500		23,500	Jan. 4	122,337,055		13,930				
127	Southwestern Gas & Electric Company	127			(c)	31,790	(o) Nov.	119,647,273		13,600				
128	Staten Island Edison Corporation	128		32,600		28,100	Nov. 26	117,999,180		13,430		29,000		
129	Cumberland County Power & Light Company	129		31,380		30,200	Dec. 17	114,835,060		13,070				
130	New York-Pennsylvania Power System (P)	130	(i)	32,000	(b)	30,101	Dec. 19	112,741,794		12,830				
131	Salem Electric Lighting Company	131		30,500		30,500	Dec. 3	112,097,459		12,760		27,000		
132	Kansas Power & Light Company	132				30,750		108,519,670		12,350				
133	Fall River Electric Light Company	133		28,800		28,400	Dec. 30	108,444,279		12,340		30,500		
134	United Electric Light Company (Springfield, Mass.)	134		39,500		39,500	Oct. 10	108,016,994		12,300		36,800		
135	Wheeling Electric Company	135						104,830,000		11,930				
	Total (C) (I)							84,214,948,103						
	Canada													
136	Hydro-Electric Power Commission of Ontario	1		802,245	(M)	794,430	Dec. 20	4,429,404,096		504,000		746,275		
137	The Shawinigan Water & Power Company	2		532,945		532,945	Nov. 13	3,409,717,522		388,000		420,300		
138	Duke-Price Power Company, Ltd.	3		321,000		315,000	Nov. 12	2,096,903,000		238,700				
139	Montreal Light, Heat & Power Consolidated	4		279,250			Nov. 26	1,450,484,998		165,100		256,760		
140	Canadian Hydro-Electric Corporation, Ltd. System*	5		286,000		280,000	Dec. 28	1,297,239,606		147,700				
141	Laurentide Power Company, Ltd.	6		129,000		124,000	Aug. 9	839,676,000		95,600		126,000		
142	Winnipeg Electric Company (J)	7		130,500		129,000	Dec. 4 & 19	654,491,510		74,500		112,000		
143	Canadian Niagara Power Company, Ltd.	8						621,423,800		70,700				
144	West Kootenay Power & Light Company, Ltd.	9				39,700	(n) Oct. 7	516,071,474		58,700				
145	City of Winnipeg Hydro-Electric System.	10		76,290		74,940	Dec. 5	400,668,600		45,600		75,834		
146	British Columbia Electric Railway Company, Ltd.	11	(p)	98,200		94,600	Dec. 18	390,564,500		44,500	(p)	87,400		
147	Canada Northern Power Corporation, Ltd. System	12		47,510		45,000	Nov. 17	343,930,010		39,150		43,690		
148	Dominion Power & Transmission Company, Ltd.	13		52,900		52,900	Nov. 19	232,656,400		26,500		56,300		
149	Southern Canada Power Company, Ltd.	14		31,700			Oct. 31	146,233,060		16,600				
	Kaministiquia Power Company, Ltd. (R)			*22,100*	(p)	*21,650*	*Jan. 10*	(R) *69,659,000*				23,300		
	Total							16,829,464,576						
	Mexico													
150	The Mexican Light & Power Company, Ltd.	1		107,608			Dec. 28	628,832,675		71,600				
151	Cia. Agricola y de Fuerza Electrica del Rio Conchos	2		24,500		23,600	Dec. 7	160,099,800		18,230	(o)	22,700		
152	Guanajuato Power & Electric Company	3						100,430,000		11,430				
	Total							889,362,475						
	Electric Railways													
153	Interborough Rapid Transit Company	1			(a)	298,760	(n) Mar. 6	1,177,155,819		134,000				
154	Chicago Surface Lines	2			(o)	195,730	Dec. 20	(r) 592,545,223	(r)	74,000		300,660		
155	Williamsburgh Power Plant Corporation (B.M.T.)	3	(o)	146,300		150,000	Feb. 6	568,889,703		64,800	(o)	138,200		
156	Philadelphia Rapid Transit Company	4				110,071	(n) Dec. 21	377,326,475		42,950				
157	The Pennsylvania Railroad (L. I. City Gen. Sta.)	5	(B)	99,600	(o)	87,700	(B) Dec. 8	333,037,210		37,900	(B)	99,600		
158	Boston Elevated Railway	6	(Q)	95,937	(Q)	91,576	Mar. 9	(Q) 252,965,140	(Q)	28,800	(Q)	94,457		
159	The New York Central Railroad Company	7	(i)	80,000	(c)	68,280	(o) Jan. 3	230,003,185		26,200	(i)	75,000		
160	The New York, New Haven & Hartford Railroad Company	8			(c)	40,750		201,191,225		22,900		50,500		
161	Pacific Electric Railway Company	9		55,000		48,000	Aug. 15	184,759,206		21,030		54,000		
162	Chicago, Milwaukee, St. Paul & Pacific Railroad Company	10						(Z) 162,274,409	(Z)	18,500				
163	Twin City Rapid Transit Company	11			(o)	46,865		135,530,869		15,430				
164	Kansas City Public Service Company	12						132,306,100		15,060		44,000		
165	Norfolk & Western Railway Company	13				30,000		127,944,156		14,570				
166	The Connecticut Company	14			(b)	18,500		109,993,477		12,500				
167	The Virginian Railway Company	15		44,000	(c)	36,000	Jan. 20	104,636,000		11,900				
	Total							4,690,558,197						

*Because of absorptions and consolidations certain companies separately listed last year have now disappeared, as shown in the following table. Minor changes of name, where the system can be readily identified are not listed.

Present Company	*Includes*
Broad River Power Co. (117)	Part of South Carolina System (Note *W*).
Canadian Hydro-Electric Corp. Ltd. System. (140)	Ottawa & Hull Power Co.
Duke Power Co. (10)	South Carolina Gas & Electric Co. listed last year as part of South Carolina System (Note *W*).
Pennsylvania Power & Light Co. (21)	East Penn Electric Co.
Southeastern Power & Light Co. System (7)	Augusta-Aiken Railway & Elec- Corp.
	Central Georgia Power Co.

(a) Actual over thirty-minute period.
(b) Actual over one-hour period.
(c) Estimated over one-hour period.
(d) Includes 12,500 kw. joint operation with Commonwealth Edison Co.
(e) Average load 9,111 kw. for five plants, four months and 14,004 kw. for six plants, eight months.
(f) Includes 24,239,872 kw.-hr. joint operation with Commonwealth Edison Co.
(g) Average of monthly maximum demands.
(h) Estimated over fifteen-minute period. (i) Estimated.
(k) Kva.
(l) For Texas Division.
(m) Over fifteen-minute period.
(n) Over thirty-minute period.
(o) Over one-hour period.
(p) Estimated over ten-minute period
(q) Over eight-hour period.
(r) Output measured on d.c. side, a
(s) Includes Keno plant, operated un
(t) Includes 214,560 kw.-hr. not bille
(u) Includes Ozark Power & Water C
(v) On same method of accounting for districts as in 1927, output in kw.-hr.

,700	12,538														133 134 135	
	48,000	Jan. 4	173,617,378	19,800	52,600		50,000	Dec. 20	172,222,651	19,860	50,300	Dec. 1	155,47
0	36,400		134,416,934	15,340	32,000		31,000	Nov. 8	128,293,150	13,800			
7	29,500	Dec. 15	135,692,265	15,490	28,600		27,500	Dec. 21	117,679,234	13,000	25,800	Sept. 30	106,99
			126,801,100	14,480	31,900		31,000	Nov. 1	123,369,160	13,400	27,300	Dec. 18	117,95
0	34,000	Nov. 30	131,861,909	15,030	32,900		31,500	Dec. 13	123,632,339	14,110			
0		Jan. 1	114,195,401	13,030			27,620	Dec. 7	100,462,550	11,468			
0	31,000	Nov. 28	131,017,494	14,950	32,530		32,000	Sept. 14	124,713,651	14,237	30,000	Dec. 4	108,31
			153,364,676	17,500		(c)	33,200	(o) Nov. 17	150,635,115	29,067	30,400	Dec. 4	(w) 128,83
0		Sept. 3	157,892,000	18,000	29,000			Sept. 4	106,141,300	12,111			
0		(A) April	140,230,159	16,000	51,500			Dec.	155,794,457	17,800	51,500	Dec.	183,62
	25,205		120,521,353	13,760									
0		(A) May 19	135,474,100	15,470		(c)	28,850		125,911,263	14,373	(x) 30,300	(y)	118,6
0	34,500	Dec. 13	112,890,480	12,880	32,500		30,000	Dec. 13	105,039,000	11,991	38,900	Feb. 4	108,82
0		Nov. 20	105,634,000	12,060	23,140			Dec. 8	104,648,573	11,644			
..	(•) 25,000	(o) Dec. 21	109,786,578	12,530	22,500			Aug. 13	111,341,210	11,263			
0	(c) 25,600	Feb. 16	107,715,140	12,290	31,500	(c)	30,000	Feb. 19 & 23	100,957,540	11,525			
	30,580		116,194,720	13,260			29,740		107,971,800	12,325			
0	27,000	Dec. 16	115,393,187	13,170	26,600			Dec. 28	100,874,562	11,515			
0		Nov. 28	108,254,302	12,360									
0	36,800	Sept. 20	101,315,500	11,570	35,830			Jan. 18	109,818,700	12,538			
5	(M) 740,530	Dec. 1	4,133,501,842	471,900	711,220	(M)	704,042	Nov. 19	3,867,398,041	441,483	635,485	Dec. 8	3,298,34
0	420,300	Oct. 18	3,021,201,950	345,000	392,330		392,330	Dec. 9	2,557,613,443	292,000	371,002	Nov. 24	2,421,04
			1,719,820,588	196,300									
0	254,000	Dec. 14	1,354,895,244	154,700	252,000		252,000	Nov. 22	1,251,502,612	142,800	233,230	Dec. 9	1,175,41
0	126,000	June 22	853,887,000	97,500									
0	107,500	Nov. 10	511,103,200	58,400	66,200		62,200	Dec. 1	285,508,300	32,592	61,100	Jan.	252,85
			604,597,700	69,000					591,893,200	67,600			
	65,600	Aug. 11	476,999,100	54,400			63,300		410,327,600	46,820			
4	72,100	Dec. 13	358,371,100	40,900	70,844		68,144	Dec. 20	324,993,710	37,100	60,321	Dec. 31	261,9
0	(c) 86,600	Dec. 21	350,402,700	40,000	79,000		77,200	Dec. 16	333,654,900	38,088	83,100	Dec. 22	336,9
0	34,850	Dec. 22	305,415,945	34,800									
0	53,000	Nov. 24	253,859,900	28,980	53,200		53,200	Dec. 15	241,355,956	21,105			
	26,300	Nov. 10	125,319,394	14,300									
0	21,600	Nov. 28	104,071,000	11,880	26,700	(p)	26,000	Nov. 26	144,638,800	16,500	28,000	Sept. 30	107,57
	(c) 102,386	(o) Nov.	606,245,844	69,200			99,644		594,046,265	67,748	(n) 98,991		561,42
0		(o) Feb. 26	156,086,800	17,820					137,149,400				112,24
	(a) 284,660	(n) Jan. 27	1,103,063,438	125,900			283,600	Jan. 28	1,063,717,242	121,224	(n) 276,380	Jan. 23	1,063,50
60		Jan. 3	(r) 577,710,827	(r) 71,900	264,000	(c)	198,463	Dec. 14	(r) 581,706,072	(r) 72,666	(i) 200,000	Feb. 27	630,50
0	142,000	Dec. 9	544,081,653	62,100	(o) 138,100		142,000	Jan. 29	542,141,625	61,888	(o) 132,300	Dec. 23	508,48
	120,318	(n) Jan. 11	371,731,556	42,400			120,290	Jan. 28	390,915,742	44,625	(n) 116,160	Jan. 28	385,70
0	(o) 87,000	(B) Dec. 9	307,432,390	35,100	(B) 88,800				286,533,764	(G) 27,350	98,000	Jan. 2	266,13
7	(Q) 90,164	Jan. 26	(Q) 243,925,965	(Q) 27,800	94,490		90,195	Jan. 29	257,696,595	29,417	94,226	Jan. 28	247,49
0	(c) 60,360		222,131,354	25,400	73,000	(b)	63,680	Dec. 27	205,649,608	22,800	(i) 70,000	Dec. 28	184,72
0	40,900	Nov. 23	189,691,700	21,650	(G) 43,000	(G,c)	32,700	Dec. 16	209,658,870	(G) 14,594	40,000	Dec. 10	209,54
0	47,000	April 6	190,485,000	21,750	52,000		46,000	Dec. 22	187,975,148	21,460	(o) 44,000	Dec. 15	183,00
			(Z) 148,560,111	(Z) 16,950					(Z) 138,083,293				136,99
	(o) 45,333	Dec. 6	137,695,684	15,720			48,428	(n) Jan. 19	140,216,985	16,007	(n) 24,460		144,41
0	41,000	Jan. 14	128,913,861	14,720	45,000		42,600	Dec. 15	131,186,730	14,976	43,000	Jan. 27-Dec. 22	127,74
			123,759,732	14,100	38,500		27,000	Oct. 30	106,426,752	12,263			
	(b) 26,925		114,168,609	13,030		(b)	25,450	(o) Feb. 10	115,769,700	13,200			

(w) At busbar.
(x) Over five-minute period, 25-cycle system 12,500 kw.; 60-cycle system 17,800 kw.
(y) 25-cycle system Dec. 2; 60-cycle system Dec. 9.
(A) Duration of peak not specified.
(B) Over five-minute period.
(C) Includes Canadian Niagara Power Co., Ltd. (See Canada).
(D) Includes 11,000 kw. joint operation with Commonwealth Edison Co.
(E) Includes 50,961,607 kw.-hr. joint generation with Commonwealth Edison Co.
(F) Maximum machine demand.
(G) On generating plant only.
(H) Includes 1928, New York Edison Co., Brooklyn Edison Co., Inc., New York & Queens Electric Light & Power Co., United Electric Light & Power Co., and Yonkers Electric Light & Power Co. In 1927 also included Westchester Lighting Co., Northern Westchester Lighting Co., Peekskill Lighting & Railroad Co. and Bronx Gas & Electric Co. but not Brooklyn Edison Co., Inc. (see also Supplement of April 30, 1927).
(I) Brooklyn Edison Co., Inc., also included under New York Edison and Allied Companies omitted from U. S. total to avoid duplication.
(J) Includes Manitoba Power Co., Ltd.
(K) Peak included in Illinois Electric Power Co.
(L) Not comparable with
(M) Over twenty-minute
(N) 25 cycle, 18,300 inst
60 cycle, 49,000 inst
(O) Includes 38,000 kw.
(P) Includes Binghamto
Northern Pennsylvan
(Q) Converted a c. measu
(R) Output under 100,00
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(S) Includes Nevada-Cal
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in 1926 would be 225,812,630

(A) Dec.	172,781,000	19,670	(A) 46,000		(A) Dec.							
Dec. 24	171,315,819	19,500	(See The New York Edison and Allied Companies)									
Dec. 20	167,613,529	19,080	50,500	48,000	Jan. 4	173,617,378	19,800	52,600	50,000	Dec. 20	172,222,651
	159,666,072	18,180	40,000	36,400		134,416,934	15,340	32,000	31,000	Nov. 8	128,293,150
(K)	156,467,174	17,810	31,727	29,500	Dec. 15	135,692,265	15,490	28,600	27,500	Dec. 21	117,679,234
	153,825,600	17,500				126,801,100	14,480	31,900	31,000	Nov. 1	123,369,160
Dec. 17	152,957,600	17,400	34,000	34,000	Nov. 30	131,861,909	15,030	32,900	31,500	Dec. 13	123,632,339
Sept. 21	152,885,453	17,400	25,340		Jan. 1	114,195,401	13,030		27,620	Dec. 7	100,462,550
Oct. 17	151,902,906	17,300	31,570	31,000	Nov. 28	131,017,494	14,950	32,530	32,000	Sept. 14	124,713,651
	149,811,913	17,060				153,364,676	17,500		(c) 33,200	(o) Nov. 17	150,635,115
Dec. 31	148,932,217	16,950									
Aug. 28	148,331,000	16,900	36,000		Sept. 3	157,892,000	18,000	29,000		Sept. 4	106,141,300
(o) Dec.	147,963,154	16,840									
(A) Aug.	146,749,000	16,700	(A) 48,500		(A) April	140,230,159	16,000	51,500		Dec.	155,794,457
(o) Nov.	146,744,975	16,700		25,205		120,521,353	13,760				
(A) Dec.	143,646,000	16,340	(A) 30,200		(A) May 19	135,474,100	15,470		(c) 28,850		125,911,263
	135,476,900	15,400									
Dec. 20	123,928,368	14,100	35,000	34,500	Dec. 13	112,890,480	12,880	32,500	30,000	Dec. 13	105,039,000
Mar. 13	122,579,000	13,950	24,600		Nov. 20	105,634,000	12,060	23,140		Dec. 8	104,648,573
Jan. 4	122,337,055	13,930		(e) 25,000	(o) Dec. 21	109,786,578	12,530	22,500		Aug. 13	111,341,210
(o) Nov.	119,647,273	13,600									
Nov. 26	117,999,180	13,430	29,000	(c) 25,600	Feb. 16	107,715,140	12,290	31,500	(c) 30,000	Feb. 19 & 23	100,957,540
Dec. 17	114,835,060	13,070		30,580		116,194,720	13,260		29,740		107,971,800
Dec. 19	112,741,794	12,830									
Dec. 3	112,097,459	12,760	27,000	27,000	Dec. 16	115,393,187	13,170	26,600		Dec. 28	100,874,562
	108,519,670	12,350									
Dec. 30	108,444,279	12,340	30,500		Nov. 28	108,254,302	12,360				
Oct. 10	108,016,994	12,300	36,800	36,800	Sept. 20	101,315,500	11,570	35,830		Jan. 18	109,818,700
	104,830,000	11,930									
	84,214,948,103										
Dec. 20	4,429,404,096	504,000	746,275	(M) 740,530	Dec. 1	4,133,501,842	471,900	711,220	(M) 704,042	Nov. 19	3,867,398,041
Nov. 13	3,409,717,522	388,000	420,300	420,300	Oct. 18	3,021,201,950	345,000	392,330	392,330	Dec. 9	2,557,613,443
Nov. 12	2,096,903,000	238,700				1,719,820,588	196,300				
Nov. 26	1,450,484,998	165,100	256,760	254,000	Dec. 14	1,354,895,244	154,700	252,000	252,000	Nov. 22	1,251,502,612
Dec. 28	1,297,239,606	147,700									
Aug. 9	839,676,000	95,600	126,000	126,000	June 22	853,887,000	97,500				
Dec. 4 & 19	654,491,510	74,500	112,000	107,500	Nov. 10	511,103,200	58,400	66,200	62,200	Dec. 1	285,508,300
	621,423,800	70,700				604,597,700	69,000				591,893,200
(n) Oct. 7	516,071,474	58,700		65,600	Aug. 11	476,999,100	54,400		63,300		410,327,600
Dec. 5	400,668,600	45,600	75,834	72,100	Dec. 13	358,371,100	40,900	70,844	68,144	Dec. 20	324,993,710
Dec. 18	390,564,500	44,500	(p) 87,400	(c) 86,600	Dec. 21	350,402,700	40,000	79,000	77,200	Dec. 16	333,654,900
Nov. 17	343,930,010	39,150	43,690	34,850	Dec. 22	305,415,945	34,800				
Nov. 19	232,656,400	26,500	56,300	53,000	Nov. 24	253,859,900	28,980	53,200	53,200	Dec. 15	241,355,956
Oct. 31	146,233,060	16,600		26,300	Nov. 10	125,319,394	14,300				
Jan. 10	(R) *69,659,000*		23,300	21,600	Nov. 28	104,071,000	11,880	26,700	(p) 26,000	Nov. 26	144,638,800
	16,829,464,576										
Dec. 28	628,832,675	71,600		(c) 102,386	(o) Nov.	606,245,844	69,200		99,644		594,046,265
Dec. 7	160,099,800	18,230	(o) 22,700		(o) Feb. 26	156,086,800	17,820				137,149,400
	100,430,000	11,430									
	889,362,475										
(n) Mar. 6	1,177,155,819	134,000		(a) 284,660	(n) Jan. 27	1,103,063,438	125,900		283,600	Jan. 28	1,063,717,242
Dec. 20	(r) 592,545,223	(r) 74,000	300,660		Jan. 3	(r) 577,710,827	(r) 71,900	264,000	(c) 198,463	Dec. 14	(r) 581,706,072
Feb. 6	568,889,703	64,800	(o) 138,200	142,000	Dec. 9	544,081,653	62,100	(o) 138,100	142,000	Jan. 29	542,141,625
(n) Dec. 21	377,326,475	42,950		120,318	(n) Jan. 11	371,731,556	42,400		120,290	Jan. 28	390,915,742
(B) Dec. 8	333,037,210	37,900	(B) 99,600	(o) 87,000	(B) Dec. 9	307,432,390	35,100	(B) 88,800			286,533,764
Mar. 9	(Q) 252,965,140	(Q) 28,800	(Q) 94,457	(Q) 90,164	Jan. 26	(Q) 243,925,965	(Q) 27,800	94,490	90,195	Jan. 29	257,696,595
(o) Jan. 3	230,003,185	26,200	(i) 75,000	(c) 60,360		222,131,354	25,400	73,000	(b) 63,680	Dec. 27	205,649,608
	201,191,225	22,900	50,500	40,900	Nov. 23	189,691,700	21,650	(G) 43,000	(G,c) 32,700	Dec. 16	209,658,870
Aug. 15	184,759,206	21,030	54,000	47,000	April 6	190,485,000	21,750	52,000	46,000	Dec. 22	187,975,148
	(Z) 162,274,409	(Z) 18,500				(Z) 148,560,111	(Z) 16,950				(Z) 138,083,293
	135,530,869	15,430		(o) 45,333	Dec. 6	137,695,684	15,720		48,428	(n) Jan. 19	140,216,985
	132,306,100	15,060	44,000	41,000	Jan. 14	128,913,861	14,720	45,000	42,600	Dec. 15	131,186,730
	127,944,156	14,570				123,759,732	14,100	38,500	27,000	Oct. 30	106,426,752
	109,993,477	12,500		(b) 26,925		114,168,609	13,030		(b) 25,450	(o) Feb. 10	115,769,700
Jan. 20	104,636,000	11,900									
	4,690,558,197										

Includes
Aiken Railway & Elec-
Georgia Power Co.
with Commonwealth
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ds.
(i) Estimated.

(k) Kva.
(l) For Texas Division.
(m) Over fifteen-minute period.
(n) Over thirty-minute period.
(o) Over one-hour period.
(p) Estimated over ten-minute period.
(q) Over eight-hour period.
(r) Output measured on d c. side, average load on a.c. side.
(s) Includes Keno plant, operated under lease.
(t) Includes 214,560 kw.-hr. not billed to the company.
(u) Includes Ozark Power & Water Co.
(v) On same method of accounting for energy transferred between districts as in 1927, output in 1926 would be 225,812,630 kw.-hr.
(w) At busbar.
(x) Over five-minute period, 25-cycle system 12,500 kw.; 60-cycle system 17,800 kw.
(y) 25-cycle system Dec. 2; 60-cycle system Dec. 9.
(A) Duration of peak not specified.
(B) Over five-minute period.
(C) Includes Canadian Niagara Power Co., Ltd. (See Canada).
(D) Includes 11,000 kw. joint operation with Commonwealth Edison Co.
(E) Includes 50,961,607 kw.-hr. joint generation with Commonwealth Edison Co.
(F) Maximum machine demand.
(G) On generating plant only.
(H) Includes 1928, New York Edis
Inc., New York & Queens E
United Electric Light & Powe
Light & Power Co. In 192
Lighting Co., Northern Westch
Lighting & Railroad Co. and
not Brooklyn Edison Co., I
April 30, 1927).
(I) Brooklyn Edison Co., Inc., al
Edison and Allied Companies
avoid duplication.
(J) Includes Manitoba Power Co.,
(K) Peak included in Illinois Elect

,081	14,445	30,000	Dec. 21	104,207,002								
,631	19,860	50,300	Dec. 1	155,470,639	48,800	Dec. 22	121,512,151	47,782	Jan. 3	133,707,946	109
,150	13,800										110
,234	13,000	25,800	Sept. 30	106,992,465							111
,160	13,400	27,300	Dec. 18	117,956,180							112
,339	14,110										113
,550	11,468										114
,651	14,237	30,000	Dec. 4	108,316,069							115
,115	29,067	30,400	Dec. 4	(w) 128,835,193	35,000	Dec.	113,239,516				116
											117
,300	12,111										118
											119
,457	17,800	51,500	Dec.	183,622,525	50,000	Dec. 31	257,757,000	45,067	Dec. 18	240,662,700	120
											121
,263	14,373	(x) 30,300	(y)	118,617,000	(B) 26,400	Dec. 10	107,440,900	24,600	Nov. 27	100,205,700	122
											123
,000	11,991	38,900	Feb. 4	108,822,300							124
,573	11,644										125
,210	11,263										126
											127
,540	11,525										128
,800	12,325										129
											130
,562	11,515										131
											132
											133
,700	12,538										134
											135
,041	441,483	635,485	Dec. 8	3,298,347,874	576,403	Dec. 22	3,026,615,156	520,084	Nov. 27	2,906,519,819	136
,443	292,000	371,002	Nov. 24	2,421,046,311	347,448	Nov. 7	2,066,066,762	272,500	Nov. 7	1,667,397,876	137
											138
,612	142,800	233,230	Dec. 9	1,175,430,654	221,060	Dec. 24	1,157,648,660	197,565	Nov. 8	1,089,099,507	139
											140
											141
,300	32,592	61,100	Jan.	252,891,600							142
,200	67,600										143
,600	46,820										144
,710	37,100	60,321	Dec. 31	261,996,380	46,065	Oct. 28	200,520,080	39,835	Nov. 20	164,609,860	145
,900	38,088	83,100	Dec. 22	336,907,650	75,200	Dec. 9	300,456,350	32,700	Dec. 29	129,548,600	146
											147
,956	21,105										148
											149
,800	16,500	28,000	Sept. 30	107,576,036							
,265	67,748	(n) 98,991		561,425,403							150
,400				112,261,000							151
											152
,242	121,224	(n) 276,380	Jan. 23	1,063,504,660	(n) 272,760	Jan. 26	1,019,620,637	254,850	Mar. 29	960,340,481	153
,072	(r) 72,666	(i) 200,000	Feb. 27	630,560,494	(o) 185,866	Dec. 23	604,581,618	170,485	Dec. 13	576,457,379	154
,625	61,888	(o) 132,300	Dec. 23	508,481,425	(o) 132,200	Dec. 26	478,911,990	126,200	Jan. 17	449,827,260	155
,742	44,625	(n) 116,160	Jan. 28	385,707,158	(n) 120,885	Jan. 21	371,519,687	115,154	Jan. 17	383,313,078	156
,764	(G) 27,350	98,000	Jan. 2	266,137,403	96,300	Dec. 26	244,345,733	70,600	Feb. 15	244,113,039	157
,595	29,417	94,226	Jan. 28	247,490,105	94,869	Jan. 21	261,091,060	82,965	Dec. 19	257,983,320	158
,608	22,800	(i) 70,000	Dec. 28	184,775,459	62,500	Dec. 24	173,938,625	47,120	Jan. 25	163,895,940	159
,870	(G) 14,594	40,000	Dec. 10	209,542,400							160
,148	21,460	(o) 44,000	Dec. 15	183,000,000	50,000	April 3	185,000,000	43,000	Dec. 21	198,211,000	161
,293				136,993,694			(i) 116,974,186			122,643,791	162
,985	16,007	(n) 24,460		144,413,357			143,000,000	51,218	Feb. 13	146,605,919	163
,730	14,976	43,000	Jan. 27-Dec. 22	127,740,470	43,000	Dec. 18	129,383,860	42,600	Feb. 14	128,302,450	164
,752	12,263										165
,700	13,200										166
											167

Edison Co., Brooklyn Edison Co., ns Electric Light & Power Co., Power Co., and Yonkers Electric 1927 also included Westchester Vestchester Lighting Co., Peekskill and Bronx Gas & Electric Co. but o., Inc. (see also Supplement of

c., also included under New York anies omitted from U. S. total to

Co., Ltd.

Electric Power Co.

(L) Not comparable with previous years because of merger.

(M) Over twenty-minute period.

(N) 25 cycle, 18,300 instantaneous, 18,000 half-hour May 11; 60 cycle, 49,000 instantaneous, 48,500 half-hour Dec. 19.

(O) Includes 38,000 kw. load of interconnected companies.

(P) Includes Binghamton Light, Heat & Power Co. and Northern Pennsylvania Power Co.

(Q) Converted a c. measured on d c. side; plus generated d.c.

(R) Output under 100,000,000 kw.-hr. for 1928, due to practical closing down of Fort William Paper Company's plant for latter six months of year.

(S) Includes Nevada-California Power Co. and Yuma Utilities Co.; prior to 1926, included Nevada-California Power Co. and Desert Water, Oil & Irrigation Co.

(T) Includes Philadelphia Electric Co., Delaware County Electric Co. and Susquehanna Electric Co.

(U) Operations for 1928 and 1927 include Bridgeport and New Haven divisions; 1926 figures for Bridgeport division only.

(V) Includes Metropolitan Edison Co., New Jersey Power & Light Co., Fleetwood & Kutztown Electric Light, Heat & Power Co., and Maryland Public Service Co.

(W) The South Carolina System formerly listed included Broad River Power Co. and South Carolina Gas & Electric Co.; the latter company was sold to Southern Power Co. (now Duke Power Co.) in 1927.

(X) Based on total generation including energy used by railway.

(Y) Plant peak 43,500 kw., Nov. 9th.

(Z) Energy consumed.

Table II—Detailed Data on Ge
of All Systems Havi

Line No.	Section and System	Generator Rating, Dec. 31, 1928				Generated and Purchased Output, 1928		
		Fuel Burning Plants		Hydro Plants		Total Output, Kw.-Hr.	Generated, Kw.-Hr.	Purchased, Kw.-Hr.
		No. of Plants	Rating of Generators, Kva.	No. of Plants	Rating of Generators, Kva.			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	New England States							
1	New England Power Association System	6	308,000	11	203,040	1,384,834,239	1,206,718,239	178,116,000
2	The Edison Electric Illuminating Company of Boston	3	395,317	0	0	857,209,496	779,936,059	77,273,437
3	The Connecticut Light & Power Company	1	83,400	2	30,600	445,804,848	353,318,700	92,486,148
4	Turners Falls Power & Electric Company	1	37,500	4	67,600	413,187,644	308,200,590	104,987,054
5	United Illuminating Company	3	60,000	0	0	275,965,650	275,962,650	3,000
6	Hartford Electric Light Company	2	107,500	1	1,875	242,563,000	151,684,000	90,879,000
7	Central Maine Power Company	2	16,875	23	76,280	240,169,182	234,427,562	5,741,620
8	Blackstone Valley Gas & Electric Company	2 (a, m)	36,650	3 (a)	1,750	182,918,142	26,741,263	156,176,879
9	New Bedford Gas & Edison Light Company	1	115,000	0	0 (p)	167,613,529 (p)	167,613,529	0
10	The Worcester Electric Light Company	1	71,225	0	0	123,928,368	107,894,400	16,033,968
11	Cumberland County Power & Light Company	1	28,125	5	26,500	114,835,060	103,920,260	10,914,800
12	Salem Electric Lighting Company	1	34,375	0	0 (q)	112,097,459 (q)	112,054,000	43,459
13	Fall River Electric Light Company	1	17,812	0	0	108,444,279	1,052,000	107,392,279
14	United Electric Light Company (Springfield, Mass.)	1	55,000	2	6,875	108,016,994	53,455,994	54,561,000
	Totals for section	26	1,375,929	51	414,955	4,777,587,890	3,882,979,246	894,608,644
	Middle Atlantic States							
15	Buffalo, Niagara & Eastern Power Corporation System (r)	2 (a)	255,000	8 (a)	550,000	4,832,459,513	3,851,261,656	981,197,857
16	The New York Edison and Allied Companies (s)	8 (a)	1,474,200	0	0	4,210,700,000	4,210,700,000	0
17	The Philadelphia Electric Company System (t)	6 (a)	586,750	1 (a)	252,000	2,266,856,345	2,246,132,660	20,723,685
18	Public Service Electric & Gas Company (N. J.)	6	611,876	0	0	1,879,024,063	1,736,606,053	142,418,010
19	The West Penn Electric Company Subsidiaries	23 (a)	456,450	9 (a)	55,655	1,764,742,160	1,737,911,306	26,830,854
20	Duquesne Light Company	2 (a)	384,000	0	0	1,434,185,024	1,431,991,772	2,193,252
21	Mohawk Hudson Power Corporation System	6	182,075	23	193,395	1,388,274,167	675,387,481	712,886,686
22	Pennsylvania Power & Light Company	17 (a)	295,037	12 (a)	42,650	1,176,653,000	827,515,000	349,138,000
23	Brooklyn Edison Company, Inc. (w)	3	619,650	0	0	1,076,612,618	1,071,231,618 (x)	5,381,000
24	Pennsylvania Water & Power Company	1	25,000	1	119,750	655,035,700	655,035,700	0
25	Pennsylvania-New Jersey Power System (B)	5	220,625	7	22,410	645,621,149	615,359,042	30,262,107
26	Northern New York Utilities, Inc.	1	6,000	23	149,000	612,905,709	508,255,600	104,650,109
27	Associated Gas & Electric System (Penna. Elec. Corp. Group)	8	90,976	4	60,340	429,933,355	426,604,736	3,328,619
28	Rochester Gas & Electric Corporation	3 (a)	76,975	6 (a)	46,530	376,764,523	331,175,481	45,589,042
29	St. Lawrence County Utilities, Inc.	0	0	0	0	341,060,000	0	341,060,000
30	Philadelphia Suburban Counties Gas & Electric Company	4 (a)	87,900	1 (a)	160	319,190,403	182,017,258	137,173,145
31	St. Lawrence Valley Power Corporation	0	0	9	64,175	309,338,919	309,338,919	0
32	The Scranton Electric Company	4 (a)	123,000	0	0	245,526,000	243,002,000	2,524,000
33	Penn Central Light & Power Company	2	91,750	2	5,125	213,808,418	210,647,389	3,161,029
34	Central Hudson Gas & Electric Corporation	3	21,700	6	29,626	213,612,676	118,417,000	95,195,676
35	Long Island Lighting Company System	..	89,000	0	0	172,923,000	172,893,000	30,000
36	Westchester Lighting Company	1	8,600	0	0	171,315,819	96,800	171,219,019
37	Atlantic City Electric Company	6 (a)	50,306	0	0	148,331,000	142,125,000	6,206,000
38	Edison Electric Company of Lancaster, Pa.	1 (a)	7,000	2 (a)	300	143,646,000	0	143,646,000
39	Staten Island Edison Corporation	1	50,500	0	0	117,999,180	117,999,180	0
40	New York-Pennsylvania Power System (G)	4	68,163	5	2,525	112,741,794	112,343,221	398,573
	Totals for section (r)( )	114	6,211,265	119	1,830,346	24,182,647,917	20,862,816,254	3,319,831,663
	South Atlantic States							
41	Duke Power Company	7	244,313	36	616,832	1,847,072,621	1,792,565,212	54,507,409
42	Appalachian Electric Power Company	8 (a)	295,900	5 (a)	31,770	1,270,328,000	1,177,092,000	93,236,000
43	Consolidated Gas Elec. Lt. & Pwr. Co. of Baltimore	3 (a)	257,000	1 (a)	600	825,430,643	441,885,665	383,544,978
44	Virginia Electric & Power Company	7	155,057	9	33,162	440,886,606	433,672,006	7,214,600
45	Carolina Power & Light Company	4 (a)	46,750	12 (a)	98,300	430,427,600	289,260,600	141,167,000
46	Potomac Electric Power Company	1	153,555	0	0	413,992,663	413,992,663	0
47	Columbus Electric & Power Company and Subsidiaries	18	17,073	9	96,370	308,177,094	307,934,774	242,320
48	Florida Power & Light Company	35 (a)	137,827	0	0	199,322,000	199,322,000	0
49	Tampa Electric Company and Subsidiaries	4 (a)	37,075	1 (a)	600	152,885,453	141,258,593	11,626,860
50	Broad River Power Company	2	60,000	3	27,694	148,932,217	139,406,720	9,525,497
51	Delaware Electric Power Company	2	31,250	0	0	122,337,055	83,625,700	38,711,355
52	Wheeling Electric Company	3 (a)	10,860	0	0	104,830,000	1,553,000	103,277,000
	Totals for section	94	1,643,248	76	938,158	6,264,621,952	5,421,568,933	843,053,019
	East North Central States							

Generator Rating, Output, Customers and Distribut
ving an Output Over 100,000,000 Kw.-Hr. During 1

	Distribution of Energy in Kilowatt-Hours, 1928									Num	
	Sold to Residential Customers (10)	Sold to Commercial Lighting Customers (tt) (11)	Sold to Municipalities (uu) (12)	Sold to Power Customers (tt) (13)	Other Sales (Heating, Etc.) (14)	Sold to Electric Railways (15)	Sold to Other Public Utilities (16)	Intra-Company Business (17)	Transmission Conversion. Distribution and Other Losses (18)	Residential (19)	Commercial Lighting (20)
000	65,013,498	59,646,640	4,079,134	457,201,022	17,669,408	(d) 106,073,915	440,762,819	(g)	(h) 234,387,803	190,449	23,984
437	110,623,637	181,877,621	(e) 44,472,418	264,376,753	0	(k) 3,756,372	103,554,323	2,876,565	145,671,807	(n) 259,161	(n) 56,402
148	35,524,397	24,025,586	6,186,869	215,358,965	0	46,440,889	(o) 38,276,839	21,326,559	58,664,744	81,384	12,850
054	0	0	23,859,200	121,613,419	0	34,611,975	186,447,358	1,678,701	44,976,991	0	0
000	(b) 88,764,921	(c)	(f)	128,455,520	0	0	3,577,200	.....	55,167,959	(l,b) 113,270	(c)
000	25,206,000	57,393,000	6,440,000	52,251,000	0	5,947,000	74,594,000	(g)	(h) 20,732,000	57,127	10,002
620	14,537,930	12,991,512	6,534,415	119,052,464	7,199,193	9,385,387	12,717,022	15,145,690	42,605,569	53,809	9,639
879	11,025,750	8,768,621	3,246,709	118,926,512	0	0	17,472,697	485,839	22,992,014	38,798	5,314
0	(b) 15,664,694	(c)	2,606,846	113,830,226	.....	.....	17,674,407	1,430,285	.....	33,175	5,118
968	17,056,074	20,007,194	1,788,040	59,001,604	5,835,275	0	19,761	5,015,622	15,204,798	45,707	7,219
800	13,389,180	15,186,435	4,240,629	38,511,390	0	888,600	453,420	20,525,909	21,639,497	35,071	6,973
459	2,807,574	2,904,886	995,351	21,815,691	69,357	5,860,800	71,296,000	(q) 4,605,547	1,742,253	9,009	1,983
279	7,376,790	5,444,972	2,866,946	71,896,048	0	0	9,388,410	600,237	10,870,876	29,038	4,242
000	16,568,957	14,038,523	7,254,991	50,853,707	0	0	6,414,950	472,052	12,413,814	(j) 50,980	(c)
644	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
857	169,860,810	268,049,544	82,013,001	3,110,886,203	0	177,085,615	628,508,611	.....	396,055,729	223,514	40,399
0	(i) 2,888,700,000	(c)	137,500,000	(c)	(c)	290,100,000	194,300,000	(g)	(h) 700,100,000	(l,j) 2,025,800	(c)
685	171,575,361	246,126,167	95,274,140	695,012,136	(u) 120,005	(k) 415,985,351	385,596,486	10,514,155	246,470,544	418,669	86,755
010	(b) 468,563,588	(c)	54,911,235	832,699,877	0	216,906,999	12,762,500	12,906,295	280,273,569	(l,b) 804,684	(c)
854	94,820,891	88,554,635	29,526,312	1,223,560,902	0	86,367,636	17,458,384	(g)	(h) 224,453,400	203,731	39,220
252	161,656,873	103,971,500	28,763,000	718,465,174	17,183,456	210,533,018	681,983	(g)	(h) 192,930,020	257,856	30,012
686	92,940,030	76,959,254	47,416,549	599,293,892	0	(v) 85,530,535	201,770,188	76,209,715	208,154,004	256,162	36,567
000	81,496,970	72,114,081	31,909,341	741,373,343	0	0	121,963,384	.....	127,795,881	227,521	39,740
000	223,697,912	185,845,274	36,539,320	383,092,461	0	3,558,400	(y) 25,816,566	(z) 67,248,396	150,814,289	(l) 672,287	(l) 103,536
0	0	0	0	0	0	0	585,895,500	.....	69,140,200	0	0
107	34,279,798	38,763,499	.....	318,801,605	0	32,593,519	86,166,667	41,458,618	93,557,443	103,426	20,188
109	5,345,773	5,067,115	1,010,754	242,500,985	1,354,611	1,920	319,752,690	593,473	37,278,388	(j) 26,376	(c)
619	32,286,626	24,767,308	4,862,261	264,154,385	64,109	11,814,085	7,498,701	12,697,947	71,787,933	87,398	15,149
042	43,698,154	(C) 184,627,522	17,321,750	(D)	0	42,632,175	10,834,581	18,150,944	59,499,397	94,363	(C) 11,256
000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
145	36,486,859	12,547,198	7,777,483	183,789,553	(u) 2,494,720	26,334,358	2,336,520	5,669,256	41,754,456	(l) 74,127	(l) 9,819
0	0	0	0	0	0	0	308,320,604	.....	1,018,315	0	0
000	.....	.....	.....	.....	.....	.....	.....	.....	.....	62,241	7,749
029	18,686,997	11,205,660	3,985,030	105,575,740	761,366	12,946,889	26,115,225	2,264,403	32,267,108	41,141	5,349
676	13,302,179	14,827,618	9,283,502	56,755,163	272,462	2,580,306	83,386,037	5,345,357	27,860,052	41,046	10,717
000	(E) 18,587,295	(c)	(c)	(c)	(c)	(c)	0	15,171,140	39,164,565	(j) 113,798	(c)
019	(b) 52,433,229	(c)	8,916,642	42,829,875	0	1,402,800	(F) 32,302,474	2,028,368	31,402,431	(j) 116,141	(c)
000	.....	.....	.....	.....	.....	.....	.....	.....	.....	64,647	11,233
000	12,175,269	13,964,695	8,964,749	67,643,982	0	18,238,744	3,811,823	.....	18,846,738	35,647	4,833
0	11,205,373	6,468,915	6,307,435	56,882,379	0	24,800,376	0	672,657	11,662,045	31,735	4,764
573	14,744,909	12,747,323	.....	48,836,164	0	661,200	1,536,259	7,403,949	12,982,990	39,234	5,734
663	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
409	(H)	(H)	(H)	H) 1,538,921,801	(H)	(H)	(H)	.....	308,150,820	.....	.....
000	.....	.....	.....	.....	.....	.....	.....	.....	.....	78,154	13,461
978	92,911,390	92,010,896	17,475,177	411,588,690	0	124,047,652	0	7,260,800	80,136,038	176,982	24,717
600	33,055,668	39,559,382	19,263,676	246,878,101	0	2,486,640	4,921,100	41,425,861	53,296,178	85,009	14,343
000	22,102,115	18,977,137	25,714,231	260,701,248	0	0	6,036,511	5,771,329	91,125,029	50,824	15,444
0	(b) 155,729,499	(c)	13,562,169	77,650,101	0	95,992,452	3,889,206	1,527,763	65,641,473	(b) 122,610	(c)
320	4,756,265	8,316,217	(I) 16,170,099	159,023,285	0	0	86,393,303	2,418,018	31,099,907	14,905	(C) 5,307
0	39,593,597	30,356,834	23,247,688	46,170,413	0	0	3,404,400	10,454,060	46,095,008	73,322	17,199
860	8,006,049	10,745,353	3,552,383	97,569,280	3,520,648	0	817,660	9,812,331	18,861,749	28,296	5,757
497	(b) 9,521,952	(c)	.....	88,283,354	0	0	21,530,476	8,050,246	21,546,189	10,514	2,693
355	9,996,120	8,676,389	1,318,825	60,575,959	0	15,499,991	14,638,323	542,062	11,089,386	25,491	5,246
900	.....	.....	.....	.....	.....	.....	.....	.....	.....	22,712	4,693
019	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

East North Central States

Supplement to ELECTRICAL WORLD, May 18, 1929

etailed Data on Generator Rating, Output, Custom
All Systems Having an Output Over 100,000,000 K

1928	Generated and Purchased Output, 1928			Distribution of Energy in Kilowatt-Hours, 1928							
dro nts Rating of Generators, Kva.	Total Output, Kw.-Hr.	Generated, Kw.-Hr.	Purchased, Kw.-Hr.	Sold to Residential Customers	Sold to Commercial Lighting Customers (tt)	Sold to Municipalities (uu)	Sold to Power Customers (tt)	Other Sales (Heating, Etc.)	Sold to Electric Railways	Sold to Other Public Utilities	
(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	
203,040	1,384,834,239	1,206,718,239	178,116,000	65,013,498	59,646,640	4,079,134	457,201,022	17,669,408 (d)	106,073,915	440,762,819	
0	857,209,496	779,936,059	77,273,437	110,623,637	181,877,621 (e)	44,472,418	264,376,753	0 (k)	3,756,372	103,554,323	
30,600	445,804,848	353,318,700	92,486,148	35,524,397	24,025,586	6,186,869	215,358,965	0	46,440,889 (o)	38,276,839	
67,600	413,187,644	308,200,590	104,987,054	0	0	23,859,200	121,613,419	0	34,611,975	186,447,358	
0	275,965,650	275,962,650	3,000 (b)	88,764,921	(c)	(f)	128,455,520	0	0	3,577,200	
1,875	242,563,000	151,684,000	90,879,000	25,206,000	57,393,000	6,440,000	52,251,000	0	5,947,000	74,594,000	
76,280	240,169,182	234,427,562	5,741,620	14,537,930	12,991,512	6,534,415	119,052,464	7,199,193	9,385,387	12,717,022	
1,750	182,918,142	26,741,263	156,176,879	11,025,750	8,768,621	3,246,709	118,926,512	0	0	17,472,697	
0 (p)	167,613,529 (p)	167,613,529	0 (b)	15,664,694	(c)	2,606,846	113,830,226	.....	.....	17,674,407	
0	123,928,368	107,894,400	16,033,968	17,056,074	20,007,194	1,788,040	59,001,604	5,835,275	0	19,761	
26,500	114,835,060	103,920,260	10,914,800	13,389,180	15,186,435	4,240,629	38,511,390	0	888,600	453,420	
0 (q)	112,097,459 (q)	112,054,000	43,459	2,807,574	2,904,886	995,351	21,815,691	69,357	5,860,800	71,296,000	(c
0	108,444,279	1,052,000	107,392,279	7,376,790	5,444,972	2,866,946	71,896,048	0	0	9,388,410	
6,875	108,016,994	53,455,994	54,561,000	16,568,957	14,038,523	7,254,991	50,853,707	0	0	6,414,950	
414,955	4,777,587,890	3,882,979,246	894,608,644	.....	.....	.....	.....	.....	.....	.....	
550,000	4,832,459,513	3,851,261,656	981,197,857	169,860,810	268,049,544	82,013,001	3,110,886,203	0	177,085,615	628,508,611	
0	4,210,700,000	4,210,700,000	0 (i)	2,888,700,000	(c)	137,500,000	(c)	(c)	290,100,000	194,300,000	
252,000	2,266,856,345	2,246,132,660	20,723,685	171,575,361	246,126,167	95,274,140	695,012,136 (u)	120,005 (k)	415,985,351	385,596,486	
0	1,879,024,063	1,736,606,053	142,418,010 (b)	468,563,588	(c)	54,911,235	832,699,877	0	216,906,999	12,762,500	
55,655	1,764,742,160	1,737,911,306	26,830,854	94,820,891	88,554,635	29,526,312	1,223,560,902	0	86,367,636	17,458,384	
0	1,434,185,024	1,431,991,772	2,193,252	161,656,873	103,971,500	28,763,000	718,465,174	17,183,456	210,533,018	681,983	
193,395	1,388,274,167	675,387,481	712,886,686	92,940,030	76,959,254	47,416,549	599,293,892	0 (v)	85,530,535	201,770,188	
42,650	1,176,653,000	827,515,000	349,138,000	81,496,970	72,114,081	31,909,341	741,373,343	0	0	121,963,384	
0	1,076,612,618	1,071,231,618 (x)	5,381,000	223,697,912	185,845,274	36,539,320	383,092,461	0	3,558,400 (y)	25,816,566	(z
119,750	655,035,700	655,035,700	0	0	0	0	0	0	0	585,895,500	
22,410	645,621,149	615,359,042	30,262,107	34,279,798	38,763,499	.....	318,801,605	0	32,593,519	86,166,667	
149,000	612,905,709	508,255,600	104,650,109	5,345,773	5,067,115	1,010,754	242,500,985	1,354,611	1,920	319,752,690	
60,340	429,933,355	426,604,736	3,328,619	32,286,626	24,767,308	4,862,261	264,154,385	64,109	11,814,085	7,498,701	
46,530	376,764,523	331,175,481	45,589,042	43,698,154 (C)	184,627,522	17,321,750	(D)	0	42,632,175	10,834,581	
0	341,060,000	0	341,060,000	.....	.....	.....	.....	.....	.....	.....	
160	319,190,403	182,017,258	137,173,145	36,486,859	12,547,198	7,777,483	183,789,553 (u)	2,494,720	26,334,358	2,336,520	
64,175	309,338,919	309,338,919	0	0	0	0	0	0	0	308,320,604	
0	245,526,000	243,002,000	2,524,000	.....	.....	.....	.....	.....	.....	.....	
5,125	213,808,418	210,647,389	3,161,029	18,686,997	11,205,660	3,985,030	105,575,740	761,366	12,946,889	26,115,225	
29,626	213,612,676	118,417,000	95,195,676	13,302,179	14,827,618	9,283,502	56,755,163	272,462	2,580,306	83,386,037	
0	172,923,000	172,893,000	30,000 (E)	18,587,295	(c)	(c)	(c)	(c)	(c)	0	
0	171,315,819	96,800	171,219,019 (b)	52,433,229	(c)	8,916,642	42,829,875	0	1,402,800 (F)	32,302,474	
0	148,331,000	142,125,000	6,206,000	.....	.....	.....	.....	.....	.....	.....	
300	143,646,000	0	143,646,000	12,175,269	13,964,695	8,964,749	67,643,982	0	18,238,744	3,811,823	
0	117,999,180	117,999,180	0	11,205,373	6,468,915	6,307,435	56,882,379	0	24,800,376	0	
2,525	112,741,794	112,343,221	398,573	14,744,909	12,747,323	.....	48,836,164	0	661,200	1,536,259	
1,830,346	24,182,647,917	20,862,816,254	3,319,831,663	.....	.....	.....	.....	.....	.....	.....	
616,832	1,847,072,621	1,792,565,212	54,507,409	(H)	(H)	(H)	H) 1,538,921,801	(H)	(H)	(H)	
31,770	1,270,328,000	1,177,092,000	93,236,000	.....	.....	.....	.....	.....	.....	.....	
600	825,430,643	441,885,665	383,544,978	92,911,390	92,010,896	17,475,177	411,588,690	0	124,047,652	0	
33,162	440,886,606	433,672,006	7,214,600	33,055,668	39,559,382	19,263,676	246,878,101	0	2,486,640	4,921,100	
98,300	430,427,600	289,260,600	141,167,000	22,102,115	18,977,137	25,714,231	260,701,248	0	0	6,036,511	
0	413,992,663	413,992,663	0 (b)	155,729,499	(c)	13,562,169	77,650,101	0	95,992,452	3,889,206	
96,370	308,177,094	307,934,774	242,320	4,756,265	8,316,217 (I)	16,170,099	159,023,285	0	0	86,393,303	
0	199,322,000	199,322,000	0	39,593,597	30,356,834	23,247,688	46,170,413	0	0	3,404,400	
600	152,885,453	141,258,593	11,626,860	8,006,049	10,745,353	3,552,383	97,569,280	3,520,648	0	817,660	
27,694	148,932,217	139,406,720	9,525,497 (b)	9,521,952	(c)	.....	88,283,354	0	0	21,530,476	
0	122,337,055	83,625,700	38,711,355	9,996,120	8,676,389	1,318,825	60,575,959	0	15,499,991	14,638,323	
0	104,830,000	1,553,000	103,277,000	.....	.....	.....	.....	.....	.....	.....	
938,158	6,264,621,952	5,421,568,933	843,053,019	.....	.....	.....	.....	.....	.....	.....	

44	Virginia Electric & Power Company			1	155,057	9	33,162	440,886,606		433,672,006		7,214,600	
45	Carolina Power & Light Company			4	(a) 46,750	12	(a) 98,300	430,427,600		289,260,600		141,167,000	

mers and Distribution of Energy
Kw.-Hr. During 1928

ic	Intra-Company Business	Transmission Conversion. Distribution and Other Losses	Number of Customers, Dec. 31, 1928: Residential	Commercial Lighting	Municipalities	Power	Other Sales (Heating, etc.)	Electric Railway	Other Public Utilities	Line No.
	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
819	(g)	(h) 234,387,803	190,449	23,984	9	6,572	67	10	49	1
323	2,876,565	145,671,807	(n) 259,161	(n) 56,402	(e) 42	(n) 14,569	0	(k,n) 3	6	2
839	21,326,559	58,664,744	81,384	12,850	.....	2,363	0	3	(o) 13	3
358	1,678,701	44,976,991	0	0	.....	.....	0	.....	.....	4
200	.....	55,167,959	(l,b) 113,270	(c)	(f)	(l) 3,288	0	0	(l) 1	5
000	(g)	(h) 20,732,000	57,127	10,002	26	53	0	1	7	6
022	15,145,690	42,605,569	53,809	9,639	735	2,140	2,898	3	11	7
697	485,839	22,992,014	38,798	5,314	6	1,633	0	0	5	8
407	1,430,285	.....	33,175	5,118	7	1,409	.....	.....	1	9
761	5,015,622	15,204,798	45,707	7,219	2	1,489	.....	0	2	10
420	20,525,909	21,639,497	35,071	6,973	29	1,992	0	2	1	11
000	(q) 4,605,547	1,742,253	9,009	1,983	1	460	29	1	1	12
410	600,237	10,870,876	29,038	4,242	5	775	0	0	3	13
950	472,052	12,413,814	(j) 50,980	(c)	(c)	(c)	0	0	(c)	14
...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
511	.....	396,055,729	223,514	40,399	251	2,236	0	22	26	15
000	(g)	(h) 700,100,000	(l,j) 2,025,800	(c)	(c)	(c)	(c)	(c)	(c)	16
486	10,514,155	246,470,544	418,669	86,755	54	17,132	(u) 213	(k) 5	5	17
500	12,906,295	280,273,569	(l,b) 804,684	(c)	.....	(l) 41,451	0	(l) 4	(l) 6	18
884	(g)	(h) 224,453,400	203,731	39,220	1,968	7,003	0	41	40	19
983	(g)	(h) 192,930,020	257,856	30,012	158	1,703	2,796	1	3	20
188	76,209,715	208,154,004	256,162	36,567	363	9,520	0	15	22	21
384	.....	127,795,881	227,521	39,740	1,668	7,571	0	0	52	22
666	(z) 67,248,396	150,814,289	(l) 672,287	(l) 103,536	(A) 1,182	(l) 14,247	0	(A) 8	(l) 5	23
500	.....	69,140,200	0	0	0	0	0	0	6	24
667	41,458,618	93,557,443	103,426	20,188	.....	4,390	0	5	19	25
590	593,473	37,278,388	(j) 26,376	(c)	(c)	(c)	(c)	(c)	(c)	26
701	12,697,947	71,787,933	87,398	15,149	.....	2,528	(O)	(O)	(P) 209	27
581	18,150,944	59,499,397	94,363	(C) 11,256	26	(D)	0	1	5	28
...	.....	.....	.....	.....	.....	.....	.....	.....	.....	29
520	5,669,256	41,754,456	(l) 74,127	(l) 9,819	(l) 275	(l) 2,126	(l,u) 1,530	(l) 17	(l) 55	30
604	.....	1,018,315	0	0	0	0	0	0	.....	31
...	.....	.....	62,241	7,749	.....	1,837	27	1	4	32
225	2,264,403	32,267,108	41,141	5,349	322	1,475	387	2	18	33
037	5,345,357	27,860,052	41,046	10,717	168	1,895	125	4	10	34
0	15,171,140	39,164,565	(j) 113,798	(c)	(c)	(c)	(c)	(c)	0	35
474	2,028,368	31,402,431	(j) 116,141	(c)	(c)	(c)	0	(c)	(c)	36
...	.....	.....	64,647	11,233	.....	1,658	464	4	2	37
823	.....	18,846,738	35,647	4,833	369	3,026	0	1	8	38
0	672,657	11,662,045	31,735	4,764	144	695	0	2	0	39
259	7,403,949	12,982,990	39,234	5,734	.....	906	0	2	9	40
...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	.....	308,150,820	.....	.....	.....	.....	.....	.....	.....	41
	.....	.....	78,154	13,461	.....	3,84[illegible]	215	6	29	42
0	7,260,800	80,136,038	176,982	24,717	18	265	0	1	0	43
100	41,425,861	53,296,178	85,009	14,343	494	3,662	0	4	2	44
511	5,771,329	91,125,029	50,824	15,444	488	3,026	0	0	5	45
206	1,527,763	65,641,473	(b) 122,610	(c)	39	8,696	0	.....	1	46
303	2,418,018	31,099,907	14,905	(C) 5,307	(I) 36	(D)	0	0	6	47
400	10,454,060	46,095,008	73,322	17,199	684	5,260	0	0	3	48
660	9,812,331	18,861,749	28,296	5,757	6	449	.....	0	3	49
476	8,050,246	21,546,189	10,514	2,693	.....	498	0	0	6	50
323	542,062	11,089,386	25,491	5,246	26	924	0	1	10	51
...	.....	.....	22,712	4,693	.....	994	146	3	.....	52
...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	124,047,652	0	7,260,800	80,136,038	176,982	24,717
800	33,055,668	39,559,382	19,263,676	246,878,101	0	2,486,640	4,921,100	41,425,861	53,296,178	85,009	14,343
000	22,102,115	18,977,137	25,714,231	260,701,248	0	0	6,036,511	5,771,329	91,125,029	50,824	15,444

(a) Kilowatts.

(b) Includes "commercial lighting."

(c) Included under "residential."

(d) Includes 59,111,492 kw.-hr., company railway system.

(e) Includes municipal street lighting; 23,891,918 kw.-hr., bills rendered, 38. Bulk sales; 20,580,500 kw.-hr., bills rendered, 4.

(f) Not metered.

(g) Included under "transmission, conversion, distribution and other losses."

(h) Includes "intra-company business."

(i) Includes also "commercial lighting, power and other sales (heating, etc.)"

(j) Includes all classes.

(k) Includes railroads.

(l) Meters.

(m) One plant (3,150 kw.) will be dismantled eventually.

(n) Bills rendered.

(o) Sold to affiliated companies or to other electric corporations, or both.

(p) Net; gross generated 169,882,200 kw.-hr.

(q) Includes current for exciters and auxiliaries; 4,361,210 kw.-hr.

(r) Canadian Niagara Power Co., Ltd., included in Buffalo, Niagara & Eastern Power Corp. System.

(s) Includes New York Edison Co., Brooklyn Edison Co., Inc., New York & Queens Electric Light & Power Co., United Electric Light & Power Co. and Yonkers Electric Light & Power Co.

(t) Includes Philadelphia Electric Co., Delaware County Electric Co. and Susquehanna Electric Co.

(u) Domestic Power.

(v) Includes 586,886 kw.-hr. used by railway section of Cortland Co.

(w) Brooklyn Edison Co., Inc., also included under New York Edison and Allied Companies omitted from totals for Middle Atlantic States to avoid duplication.

(x) Received from inter-connected companies.

938,158	6,264,621,952	5,421,568,933	843,053,019									
44	Virginia Electric & Power Company		7		155,057	9		33,162	440,886,606		433,672,006	7,214,600
45	Carolina Power & Light Company		4	(a)	46,750	12	(a)	98,300	430,427,600		289,260,600	141,167,000
46	Potomac Electric Power Company		1		153,555	0		0	413,992,663		413,992,663	0
47	Columbus Electric & Power Company and Subsidiaries		18		17,073	9		96,370	308,177,094		307,934,774	242,320
48	Florida Power & Light Company		35	(a)	137,827	0		0	199,322,000		199,322,000	0
49	Tampa Electric Company and Subsidiaries		4	(a)	37,075	1	(a)	600	152,885,453		141,258,593	11,626,860
50	Broad River Power Company		2		60,000	3		27,694	148,932,217		139,406,720	9,525,497
51	Delaware Electric Power Company		2		31,250	0		0	122,337,055		83,625,700	38,711,355
52	Wheeling Electric Company		3	(a)	10,860	0		0	104,830,000		1,553,000	103,277,000
	Totals for section		94		1,643,248	76		938,158	6,264,621,952		5,421,568,933	843,053,019
	East North Central States											
53	Commonwealth Edison Company		6	(a)	1,104,500	0		0	4,174,661,000		3,865,761,000	308,900,000
54	The Detroit Edison Company		4	(a)	713,000	7	(a)	9,160	2,438,304,900		2,432,021,000	6,283,900
55	The Ohio Power Company		14	(a)	227,245	4	(a)	2,850	1,305,004,000		1,096,652,000	208,352,000
56	The Cleveland Electric Illuminating Company		5	(a)	415,250	0		0	1,282,476,855		1,281,738,313	738,542
57	The North American Co. System (Wis.-Michigan Group)		11	(a)	363,384	11	(a)	15,943	1,148,886,380		1,000,010,217	148,876,163
58	Consumers Power Company		10	(a)	186,000	33	(a)	109,005	1,102,278,322		953,931,942	148,346,380
59	Columbia Gas & Electric Corporation System		10		373,649	0		0	1,052,549,327		1,052,501,227	48,100
60	Public Service Company of Northern Illinois		15	(a)	246,275	3	(a)	4,100	1,047,466,830		775,177,904	272,288,926
61	The Pennsylvania-Ohio System		2		210,000	1		1,250	606,647,383		602,772,315	3,875,068
62	The Ohio Public Service Company		8		162,625	0		0	559,090,541		389,727,233	169,363,308
63	The Toledo Edison Company		3	(a)	125,180	2	(a)	6,860	458,973,651		338,929,753	120,043,898
64	Indiana & Michigan Electric Company		2	(a)	94,000	4	(a)	22,004	454,600,000		432,312,000	22,288,000
65	Central Indiana Power Company Subsidiaries		13	(a)	92,275	1	(a)	384	383,337,429		316,264,840	67,072,589
66	Northern Ohio Power & Light Company		1	(a)	67,000	1	(a)	2,200	378,609,988		189,630,110	188,979,878
67	Indianapolis Power & Light Company		3		127,500	0		0	356,228,046		330,172,750	26,055,296
68	Central Illinois Public Service Company		16	(a)	90,795	0		0	339,189,800		238,701,685	100,488,115
69	Northern Indiana Public Service Company		1		30,000	2		540	302,031,809		86,376,829	215,654,980
70	The Columbus Railway, Power & Light Company		3		180,000	0		0	283,654,155		284,401,000	—746,845
71	Wisconsin Power & Light Company		7	(a)	22,450	36	(a)	37,830	283,520,629		254,761,946	28,758,683
72	Interstate Public Service Company		10	(a)	47,737	5	(a)	5,440	272,698,429		140,951,820	131,746,609
73	Michigan Northern Power Company		0		0	1		45,600	270,078,433		270,078,433	0
74	Illinois Electric Power Company		2	(a)	83,000	0		0	228,660,184		227,866,984	793,200
75	Illinois Power & Light Corporation (Southern Group)	(R)	10		27,000	0		0	187,171,597	(S)	9,817,590	177,354,007
76	City of Cleveland, Division of Light & Power		1		50,000	0		0	186,242,950		186,242,950	0
77	Illinois Power & Light Corporation (Central Group)		9		51,245	0		0	184,066,909	(S)	122,490,409	61,576,500
78	Central Illinois Light Company		1	(a,T)	500	0		0	156,467,174		779,990	155,687,184
79	Indiana Service Corporation		1		38,750	0		0	152,957,600		123,868,300	29,089,300
80	Moline-Rock Island Manufacturing Company		2		44,150	0		0	151,902,906		112,012,000	39,890,906
81	Wisconsin Public Service Corporation		3		49,688	9		37,025	149,811,913		143,944,287	5,867,626
82	Terre Haute, Indianapolis & Eastern Traction Company		6		48,150	0		0	135,476,900		90,274,910	45,201,990
83	Indiana General Service Company		3	(a)	39,450	0		0	122,579,000		109,240,000	13,339,000
	Totals for section		182		6,292,757	120		354,115	20,155,625,040		17,459,411,737	2,696,213,303
	West North Central States											
84	The North American Co. Sys. (Mo., Ill. and Iowa Group)		7	(a)	362,020	1	(a)	135,000	1,719,825,708		1,719,797,598	28,110
85	Northern States Power Company and Subsidiaries		23		283,841	27		166,306	908,760,906		824,992,812	83,768,094
86	Kansas City Power & Light Company		4		230,267	0		0	584,714,544		584,474,395	240,149
87	Minnesota Power & Light Company		5	(a)	12,350	11	( )	94,911	416,134,000		415,730,000	404,000
88	Kansas Gas & Electric Company		6	(a)	74,160	0		0	249,717,000		249,441,000	276,000
89	The Empire District Electric Company		1		77,125	3		13,625	226,034,240		225,946,900	87,340
90	Nebraska Power Company		2	(a)	73,140	1	(a)	126	219,813,000		219,353,000	460,000
91	Des Moines Electric Light Company		3		89,240	1		300	159,666,072	(S)	158,781,772	884,300
92	Kansas Power & Light Company		6		46,425	0		0	108,519,670	(S)	106,353,462	2,166,208
	Totals for section		57		1,378,898	44		467,731	4,593,185,140		4,504,870,939	88,314,201
	East South Central States											
93	Southeastern Power & Light Company System		72	(Y)	205,819	25	(Y)	657,490	2,358,032,225		2,034,085,390	323,046,,835
94	The Tennessee Electric Power Company		4	(a)	103,750	7	(a)	108,052	730,061,103		702,962,753	27,098,350
95	Birmingham Electric Company		1	(a)	11,700	0		0	298,379,513		0	298,379,513
96	Louisville Gas & Electric Company and Subsidiaries		2		116,900	1		100,400	285,767,900		258,472,400	27,295,500
97	U. S. Government (Muscle Shoals)		0		0	1		230,000	222,096,800		222,096,800	0
98	Kentucky & West Virginia Power Company		1	(a)	19,500	0		0	194,912,000		41,552,000	153,360,000
99	Kentucky Utilities Company		25	(a)	58,167	0		0	194,822,819		124,419,131	70,403,688
100	Memphis Power & Light Company		1	(a)	54,000	0		0	172,781,000		167,211,000	5,570,000
	Totals for section		106		631,719	34		1,122,890	4,456,853,360		3,550,799,474	906,053,886
	West South Central States											
101	Oklahoma Gas & Electric Company		28		180,325	0		0	567,869,411		504,768,794	63,100,617
102	Houston Lighting & Power Company		6	(a)	99,486	0		0	436,633,000		433,714,000	2,919,000
103	Louisiana Power & Light Company		16	(a)	91,668	0		0	390,533,000		330,117,000	60,416,000
104	Texas Electric Service Company		17	(a)	51,422	0		0	381,404,000		301,910,000	79,494,000
105	Texas Power & Light Company		31	(a)	67,584	4	(a)	440	374,563,000		263,754,000	110,809,000
106	New Orleans Public Service, Inc.		3	(a)	112,700	0		0	338,629,000		338,629,000	0
107	Arkansas Power & Light Company		46	(a)	40,410	3	(a)	9,666	259,164,000		77,153,000	182,011,000
108	Public Service Company of Oklahoma		12	(a)	64,945	0		0	224,426,315		197,579,279	26,847,036
109	Gulf States Utilities Company		10	(a)	82,783	0		0	(Z)	191,081,273	(Z)	190,989,773	91,500
110	Dallas Power & Light Company		1	(a)	57,500	0		0	179,165,000		177,127,000	2,038,000
111	West Texas Utilities Company		26	(a)	39,540	0		0	147,963,154		139,462,783	8,500,371
112	Fort Worth Power & Light Company		1	(a)	44,000	0		0	146,749,000		146,090,000	659,000
113	Central Power & Light Company		52	(a)	61,131	5	(a)	4,178	146,744,975		128,361,536	18,383,439
114	Southwestern Gas & Electric Company		21	(a)	51,210	0		0	119,647,273		114,636,293	5,010,980
	Totals for sections		270		1,260,325	12		17,850	3,904,572,401		3,344,292,458	560,279,943
	Mountain States											
115	The Montana Power Company		0		0	11	(a)	210,900	1,583,985,000		1,573,229,000	10,756,000
116	Utah Power & Light Company		4	(a)	37,040	35	(a)	188,847	830,862,000		513,712,000	317,150,000
117	Idaho Power Company		0		0	8	(a)	71,500	506,009,000		475,136,000	30,873,000
118	Public Service Company of Colorado		10	(a)	82,025	9	(a)	33,200	298,387,145		289,374,240	9,012,905
119	Salt River Valley Water Users' Association		0		0	7		64,400	275,550,594		256,398,777	19,151,817
	Totals for section		14		148,800	70		694,400	3,494,793,739		3,107,850,017	386,943,722
	Pacific States											

600	825,430,643	441,885,665	383,544,978	92,911,390	92,010,896	17,475,177	411,588,690		0	124,047,652		

panies.

600		33,055,668		39,559,382		19,263,676	246,878,101		0	2,486,640	4,921,100	41,425,861	53,296,178	85,009	14,343
000		22,102,115		18,977,137		25,714,231	260,701,248		0	0	6,036,511	5,771,329	91,125,029	50,824	15,444
0	(b)	155,729,499		(c)		13,562,169	77,650,101		0	95,992,452	3,889,206	1,527,763	65,641,473	(b) 122,610	(c)
320		4,756,265		8,316,217	(I)	16,170,099	159,023,285		0	0	86,393,303	2,418,018	31,099,907	14,905	(C) 5,307
0		39,593,597		30,356,834		23,247,688	46,170,413		0	0	3,404,400	10,454,060	46,095,008	73,322	17,199
860		8,006,049		10,745,353		3,552,383	97,569,280		3,520,648	0	817,660	9,812,331	18,861,749	28,296	5,757
497	(b)	9,521,952		(c)			88,283,354		0	0	21,530,476	8,050,246	21,546,189	10,514	2,693
355		9,996,120		8,676,389		1,318,825	60,575,959		0	15,499,991	14,638,323	542,062	11,089,386	25,491	5,246
000														22,712	4,693
019															
000		438,323,000		422,371,000			(J)1,676,462,000		0	927,535,000	(o) 323,555,000	16,287,000	370,128,000	780,273	131,064
900	(K)	259,562,571		274,782,241		64,462,646	1,234,274,892		0	(L) 125,769,990	119,072,660	25,169,300	335,210,600	(K) 462,060	69,386
000														150,852	24,498
542		146,932,924		104,630,469		17,340,594	634,814,390		4,875,423	127,380,815	95,377,390	4,051,794	147,073,056	254,618	34,090
163	(b)	241,452,380		(c)		11,780,711	542,897,453		0	3,436,068	50,885,699	133,837,039	164,597,030	(b) 266,123	(c)
380		105,653,617		96,729,777		16,001,338	578,156,399		0	65,428,624	18,447,254	9,202,671	212,658,642	235,787	35,308
100		110,555,818		94,337,911		42,664,761	479,428,435		0	107,874,256	55,726,586	29,829,806	132,131,754	258,666	36,896
926		97,539,053		47,773,801		50,189,042	343,597,533		6,118,047	88,756,707	259,779,279	11,006,173	142,707,195	222,521	28,521
068		40,941,313		42,719,366		2,805,330	344,206,041		0	35,390,300	65,498,067	1,815,549	73,271,417	81,789	11,287
308		33,362,488		30,017,471		17,634,415	366,248,461		0	0	52,695,444	(Q) 5,553,260	53,579,002	66,279	10,140
898		38,062,338		44,223,234		9,721,610	228,086,349		0	39,755,054	28,279,776	3,078,589	67,766,701	82,151	10,343
000														51,872	6,742
589		13,398,948		10,893,824		4,161,020	84,501,197	(M)	1,472,548	99,035,603	100,270,076	19,339,752	50,264,461	42,277	8,929
878		38,586,581		28,197,512		24,311,278	194,466,514		0	(N) 39,243,186	6,656,630	1,620,247	45,528,040	60,631	7,613
296		39,565,712		2,055,981		16,465,860	217,671,350		0	0	9,357,670	13,032,645	58,078,828	94,128	4,014
115		35,588,069		22,836,728		14,529,554	135,966,359	(M)	2,021,872	1,805,090	39,782,685	28,791,547	57,867,896	105,544	22,347
980		22,617,600		20,007,839		15,791,739	158,965,088		0	35,753,552	1,170,240	1,624,496	46,101,255	56,804	9,040
845		36,201,316		42,218,289		2,211,289	102,651,028		230,593	33,852,183	26,759,608	12,007,042	27,522,807	75,902	9,230
683		20,404,183		15,459,854		6,748,021	40,197,079	(M)	2,520,052	291,600	140,484,768	15,714,455	41,700,617	56,904	9,998
609		24,223,942		18,568,052		9,787,105	117,535,967	(M)	1,495,554	3,372,015	24,758,131	26,739,389	46,218,274	73,458	13,618
0		0		0		0	267,192,295		0	655,200	1,901,003	329,935		0	0
200		0		0		0	0		0	0	224,767,916		3,892,268	0	0
007		16,119,285		12,667,009		5,341,211	92,198,558		0	16,107,468	381,628	1,096,086	43,260,352	58,968	11,449
0		20,877,410		17,517,951		29,038,769	80,118,787		0	0	0		38,690,033	37,317	5,708
500		20,467,247		20,030,111		3,494,648	53,718,365		0	21,838,186	2,448,327	9,695,521	52,374,504	58,214	9,811
184		14,487,141		11,743,424		4,290,236	99,621,731		0	0	12,884,877	148,400	13,291,365	32,693	5,750
300		7,002,594		11,708,518		5,902,393	69,401,345		0	4,255,857	(o) 8,480,526	(U) 34,348,643	11,857,724	18,622	3,265
906		0		0		0	0		0	20,124,202	122,416,909	5,673,795	3,688,000	0	0
626		11,076,899		10,670,931		4,452,450	82,588,473		0	1,191,380	7,771,068	5,139,332	26,921,380	31,811	5,719
990	(b)	15,499,179		(c)		2,940,011	58,043,012		0	6,385,835	3,024,822	40,327,581	9,256,460	(b) 26,171	(c)
000														28,998	3,454
303															
110		132,801,001		151,529,547		36,413,072	695,613,274		0	1,727,359	469,870,759	29,458,460	202,412,236	266,787	43,125
094		113,882,808		128,524,235		71,320,394	354,686,175		0	2,529,939	41,752,822	13,607,606	182,456,927	274,355	47,059
149		56,388,633		97,621,876		19,692,443	199,284,425		0	132,507,589	20,732,980	2,738,768	55,747,830	101,905	19,051
000		16,385,210		16,735,738		24,204,830	232,209,522		0	0	56,557,922	836,731	69,204,047	37,442	7,284
000		21,425,344		20,582,145		7,668,880	130,048,437		0	0	27,177,494		42,814,700	47,158	8,231
340		6,240,919		8,118,020		945,594	132,005,770		0	4,313,400	32,127,796	1,017,447	41,265,294	(X) 17,458	(X) 4,476
000		29,085,262		35,675,719		6,418,515	94,505,674		0	0	33,003,200		21,124,630	53,475	8,481
300		18,905,657		11,124,560		7,510,187	66,550,754		0	0	24,668,852	1,063,240	29,842,822	47,345	5,658
208		9,334,757		12,263,272		1,186,095	24,775,615		1,022,570	0	36,188,657	3,471,159	20,277,545	26,229	4,404
201															
835		89,885,929		97,051,775		30,795,992	1,223,671,227	(M)	848,069	77,657,859	366,810,293	24,136,947	447,174,134	206,631	53,827
350		34,091,797		26,934,102		3,166,006	377,040,290		0	4,866,540	138,003,616	37,206,925	108,751,827	75,429	15,418
513		19,456,044		27,799,749		3,816,906	163,929,171		0	0	0	48,330,407	35,047,236	51,879	8,627
500		30,231,767		41,347,079		13,275,233	105,397,541		0	0	62,985,200	3,511,449	29,019,631	75,522	11,354
0		0		0		0	0		0	0	216,859,000	5,237,800	0	0	0
000														12,934	2,671
688		11,781,787		11,334,500		5,558,782	98,639,371	(M)	709,686	0	27,818,701	13,389,392	25,590,600	42,074	10,189
000		16,086,234		40,294,849		5,172,956	40,837,202		0	0	49,843,208	834,866	19,711,685	36,289	8,612
886															
617		31,807,479		39,460,144		13,971,506	347,446,201		0	17,760,477	17,680,771	5,369,869	94,372,964	89,253	20,981
000		25,617,181		18,552,604		20,656,637	253,461,663		0	0	71,129,718		47,215,197	63,518	10,967
000		3,275,663		3,368,282		2,681,584	131,175,905		0	0	235,704,471	2,202,138	12,124,957	13,124	4,082
000		12,149,585		12,936,807		6,786,645	134,359,480		0	0	172,074,782		43,096,701	26,848	7,969
000		29,545,446		19,953,305		22,486,845	194,916,415		0	0	39,044,006	25,580	68,591,403	76,411	20,601
0		29,561,092		26,574,378		12,821,012	117,073,141		0	0	57,453,999	49,276,271	45,869,107	68,712	15,170
000		13,070,600		19,621,750		8,374,715	121,622,046		0	0	23,384,103	19,127,085	53,963,701	41,435	12,843
036		17,683,690		15,554,300		6,815,344	81,767,703	(M)	190,914	4,863,970	55,475,060	17,069,460	25,005,874	46,447	9,914
500		8,364,202		9,822,650		4,088,331	104,368,671		0	3,978,584	33,340,528	5,648,779	21,469,528	(aa) 29,234	(c)
000		23,119,297		26,060,700		11,600,098	65,424,625		0	0	33,421,585		19,538,695	53,926	6,923
371		16,995,290		9,378,191		3,933,067	69,118,828	(M)	550,933	292,578	2,423,958	15,567,384	29,702,925	38,990	10,606
000		11,176,377		12,306,518		9,700,169	91,493,399		0	0	5,937,000		16,135,537	31,766	4,228
439		12,447,645		12,420,532		5,443,578	37,605,328	(M)	11,768,324	0	3,252,511	33,890,874	29,916,183	28,873	14,710
980		12,278,950		18,633,018		5,895,826	44,278,376	(M)	278,275	7,746,901	1,694,157	12,808,590	16,033,180	41,042	9,077
943															
000													(j)	51,432	
000		37,575,972		36,701,393		12,715,118	557,405,245		0	0	51,437,532		135,026,740	84,939	12,156
000		30,754,762		13,459,338		9,059,183	67,863,518		0	0	325,793,766		59,078,433	34,371	5,726
905		33,704,602		45,971,138		9,197,072	122,663,026		0	295,338	18,457,912	6,873,862	61,224,195	97,621	15,829
817		1,716,430		0		9,759,122	166,447,231		0	0	30,109,965	33,211,277	34,306,569	932	0
722															

	7,260,800	80,136,038	176,982	24,717	18	265	0	1	0	43					

Pacific States

600	825,430,643	441,885,665	383,544,978		92,911,390	92,010,896	17,475,177	411,588,690		0	124,047,652		
33,162	440,886,606	433,672,006	7,214,600		33,055,668	39,559,382	19,263,676	246,878,101		0	2,486,640		4,921,100
98,300	430,427,600	289,260,600	141,167,000		22,102,115	18,977,137	25,714,231	260,701,248		0	0		6,036,511
0	413,992,663	413,992,663	0	(b)	155,729,499	(c)	13,562,169	77,650,101		0	95,992,452		3,889,206
96,370	308,177,094	307,934,774	242,320		4,756,265	8,316,217	(I) 16,170,099	159,023,285		0	0		86,393,303
0	199,322,000	199,322,000	0		39,593,597	30,356,834	23,247,688	46,170,413		0	0		3,404,400
600	152,885,453	141,258,593	11,626,860		8,006,049	10,745,353	3,552,383	97,569,280		3,520,648	0		817,660
27,694	148,932,217	139,406,720	9,525,497	(b)	9,521,952	(c)		88,283,354		0	0		21,530,476
0	122,337,055	83,625,700	38,711,355		9,996,120	8,676,389	1,318,825	60,575,959		0	15,499,991		14,638,323
0	104,830,000	1,553,000	103,277,000										
938,158	6,264,621,952	5,421,568,933	843,053,019										
0	4,174,661,000	3,865,761,000	308,900,000		438,323,000	422,371,000		(J) 1,676,462,000		0	927,535,000	(o)	323,555,000
9,160	2,438,304,900	2,432,021,000	6,283,900	(K)	259,562,571	274,782,241	64,462,646	1,234,274,892		0	(L) 125,769,990		119,072,660
2,850	1,305,004,000	1,096,652,000	208,352,000										
0	1,282,476,855	1,281,738,313	738,542		146,932,924	104,630,469	17,340,594	634,814,390		4,875,423	127,380,815		95,377,390
15,943	1,148,886,380	1,000,010,217	148,876,163	(b)	241,452,380	(c)	11,780,711	542,897,453		0	3,436,068		50,885,699
109,005	1,102,278,322	953,931,942	148,346,380		105,653,617	96,729,777	16,001,338	578,156,399		0	65,428,624		18,447,254
0	1,052,549,327	1,052,501,227	48,100		110,555,818	94,337,911	42,664,761	479,428,435		0	107,874,256		55,726,586
4,100	1,047,466,830	775,177,904	272,288,926		97,539,053	47,773,801	50,189,042	343,597,533		6,118,047	88,756,707		259,779,279
1,250	606,647,383	602,772,315	3,875,068		40,941,313	42,719,366	2,805,330	344,206,041		0	35,390,300		65,498,067
0	559,090,541	389,727,233	169,363,308		33,362,488	30,017,471	17,634,415	366,248,461		0	0		52,695,444 (Q)
6,860	458,973,651	338,929,753	120,043,898		38,062,338	44,223,234	9,721,610	228,086,349		0	39,755,054		28,279,776
22,004	454,600,000	432,312,000	22,288,000										
384	383,337,429	316,264,840	67,072,589		13,398,948	10,893,824	4,161,020	84,501,197	(M)	1,472,548	99,035,603		100,270,076
2,200	378,609,988	189,630,110	188,979,878		38,586,581	28,197,512	24,311,278	194,466,514		0	(N) 39,243,186		6,656,630
0	356,228,046	330,172,750	26,055,296		39,565,712	2,055,981	16,465,860	217,671,350		0	0		9,357,670
0	339,189,800	238,701,685	100,488,115		35,588,069	22,836,728	14,529,554	135,966,359	(M)	2,021,872	1,805,090		39,782,685
540	302,031,809	86,376,829	215,654,980		22,617,600	20,007,839	15,791,739	158,965,088		0	35,753,552		1,170,240
0	283,654,155	284,401,000	—746,845		36,201,316	42,218,289	2,211,289	102,651,028		230,593	33,852,183		26,759,608
37,830	283,520,629	254,761,946	28,758,683		20,404,183	15,459,854	6,748,021	40,197,079	(M)	2,520,052	291,600		140,484,768
5,440	272,698,429	140,951,820	131,746,609		24,223,942	18,568,052	9,787,105	117,535,967	(M)	1,495,554	3,372,015		24,758,131
45,600	270,078,433	270,078,433	0		0	0	0	267,192,295		0	655,200		1,901,003
0	228,660,184	227,866,984	793,200		0	0	0	0		0	0		224,767,916
0	187,171,597	(S) 9,817,590	177,354,007		16,119,285	12,667,009	5,341,211	92,198,558		0	16,107,468		381,628
0	186,242,950	186,242,950	0		20,877,410	17,517,951	29,038,769	80,118,787		0	0		0
0	184,066,909	(S) 122,490,409	61,576,500		20,467,247	20,030,111	3,494,648	53,718,365		0	21,838,186		2,448,327
0	156,467,174	779,990	155,687,184		14,487,141	11,743,424	4,290,236	99,621,731		0	0		12,884,877
0	152,957,600	123,868,300	29,089,300		7,002,594	11,708,518	5,902,393	69,401,345		0	4,255,857	(o)	8,480,526 (U
0	151,902,906	112,012,000	39,890,906		0	0	0	0		0	20,124,202		122,416,909
37,025	149,811,913	143,944,287	5,867,626		11,076,899	10,670,931	4,452,450	82,588,473		0	1,191,380		7,771,068
0	135,476,900	90,274,910	45,201,990	(b)	15,499,179	(c)	2,940,011	58,043,012		0	6,385,835		3,024,822
0	122,579,000	109,240,000	13,339,000										
354,115	20,155,625,040	17,459,411,737	2,696,213,303										
135,000	1,719,825,708	1,719,797,598	28,110		132,801,001	151,529,547	36,413,072	695,613,274		0	1,727,359		469,870,759
166,306	908,760,906	824,992,812	83,768,094		113,882,808	128,524,235	71,320,394	354,686,175		0	2,529,939		41,752,822
0	584,714,544	584,474,395	240,149		56,388,633	97,621,876	19,692,443	199,284,425		0	132,507,589		20,732,980
94,911	416,134,000	415,730,000	404,000		16,385,210	16,735,738	24,204,830	232,209,522		0	0		56,557,922
0	249,717,000	249,441,000	276,000		21,425,344	20,582,145	7,668,880	130,048,437		0	0		27,177,494
13,625	226,034,240	225,946,900	87,340		6,240,919	8,118,020	945,594	132,005,770		0	4,313,400		32,127,796
126	219,813,000	219,353,000	460,000		29,085,262	35,675,719	6,418,515	94,505,674		0	0		33,003,200
300	159,666,072	(S) 158,781,772	884,300		18,905,657	11,124,560	7,510,187	66,550,754		0	0		24,668,852
0	108,519,670	(S) 106,353,462	2,166,208		9,334,757	12,263,272	1,186,095	24,775,615		1,022,570	0		36,188,657
467,731	4,593,185,140	4,504,870,939	88,314,201										
657,490	2,358,032,225	2,034,085,390	323,046,,835		89,885,929	97,051,775	30,795,992	1,223,671,227	(M)	848,069	77,657,859		366,810,293
108,052	730,061,103	702,962,753	27,098,350		34,091,797	26,934,102	3,166,006	377,040,290		0	4,866,540		138,003,616
0	298,379,513	0	298,379,513		19,456,044	27,799,749	3,816,906	163,929,171		0	0		0
100,400	285,767,900	258,472,400	27,295,500		30,231,767	41,347,079	13,275,233	105,397,541		0	0		62,985,200
230,000	222,096,800	222,096,800	0		0	0	0	0		0	0		216,859,000
0	194,912,000	41,552,000	153,360,000										
0	194,822,819	124,419,131	70,403,688		11,781,787	11,334,500	5,558,782	98,639,371	(M)	709,686	0		27,818,701
0	172,781,000	167,211,000	5,570,000		16,086,234	40,294,849	5,172,956	40,837,202		0	0		49,843,208
1,122,890	4,456,853,360	3,550,799,474	906,053,886										
0	567,869,411	504,768,794	63,100,617		31,807,479	39,460,144	13,971,506	347,446,201		0	17,760,477		17,680,771
0	436,633,000	433,714,000	2,919,000		25,617,181	18,552,604	20,656,637	253,461,663		0	0		71,129,718
0	390,533,000	330,117,000	60,416,000		3,275,663	3,368,282	2,681,584	131,175,905		0	0		235,704,471
0	381,404,000	301,910,000	79,494,000		12,149,585	12,936,807	6,786,645	134,359,480		0	0		172,074,782
440	374,563,000	263,754,000	110,809,000		29,545,446	19,953,305	22,486,845	194,916,415		0	0		39,044,006
0	338,629,000	338,629,000	0		29,561,092	26,574,378	12,821,012	117,073,141		0	0		57,453,999
9,666	259,164,000	77,153,000	182,011,000		13,070,600	19,621,750	8,374,715	121,622,046		0	0		23,384,103
0	224,426,315	197,579,279	26,847,036		17,683,690	15,554,300	6,815,344	81,767,703	(M)	190,914	4,863,970		55,475,060
0	(Z) 191,081,273	(Z) 190,989,773	91,500		8,364,202	9,822,650	4,088,331	104,368,671		0	3,978,584		33,340,528
0	179,165,000	177,127,000	2,038,000		23,119,297	26,060,700	11,600,098	65,424,625		0	0		33,421,585
0	147,963,154	139,462,783	8,500,371		16,995,290	9,378,191	3,933,067	69,118,828	(M)	550,933	292,578		2,423,958
0	146,749,000	146,090,000	659,000		11,176,377	12,306,518	9,700,169	91,493,399		0	0		5,937,000
4,178	146,744,975	128,361,536	18,383,439		12,447,645	12,420,532	5,443,578	37,605,328	(M)	11,768,324	0		3,252,511
0	119,647,273	114,636,293	5,010,980		12,278,950	18,633,018	5,895,826	44,278,376	(M)	278,275	7,746,901		1,694,157
17,850	3,904,572,401	3,344,292,458	560,279,943										
210,900	1,583,985,000	1,573,229,000	10,756,000										
188,847	830,862,000	513,712,000	317,150,000		37,575,972	36,701,393	12,715,118	557,405,245		0	0		51,437,532
71,500	506,009,000	475,136,000	30,873,000		30,754,762	13,459,338	9,059,183	67,863,518		0	0		325,793,766
33,200	298,387,145	289,374,240	9,012,905		33,704,602	45,971,138	9,197,072	122,663,026		0	295,338		18,457,912
64,400	275,550,594	256,398,777	19,151,817		1,716,430	0	9,759,122	166,447,231		0	0		30,109,965
694,400	3,494,793,739	3,107,850,017	386,943,722										

97	U. S. Government (Muscle Shoals)			0		0	1	230,000		222,096,800	222,096,800		0
98	Kentucky & West Virginia Power Company			1	(q) 19,500	0		0		194,912,000	41,552,000		153,360,000

	7,260,800	80,136,038		176,982	24,717	18	265		0	1		0	43
0	41,425,861	53,296,178		85,009	14,343	494	3,662		0	4		2	44
1	5,771,329	91,125,029		50,824	15,444	488	3,026		0	0		5	45
6	1,527,763	65,641,473	(b)	122,610	(c)	39	8,696		0	.....		1	46
3	2,418,018	31,099,907		14,905	(C) 5,307	(I) 36	(D)		0	0		6	47
0	10,454,060	46,095,008		73,322	17,199	684	5,260		0	0		3	48
0	9,812,331	18,861,749		28,296	5,757	6	449	.....		0		3	49
6	8,050,246	21,546,189		10,514	2,693	.....	498		0	0		6	50
3	542,062	11,089,386		25,491	5,246	26	924		0	1		10	51
	.....	.....		22,712	4,693	.....	994		146	3	.....		52
	.....	.....		.....	.....	.....	.....		.....	.....	.....	.....	.....
0	16,287,000	370,128,000		780,273	131,064	.....	(J) 19,037		0	4	(o)	2	53
0	25,169,300	335,210,600	(K)	462,060	69,386	172	12,524		0	2		4	54
	.....	.....		150,852	24,498	.....	6,252		1,060	31		37	55
0	4,051,794	147,073,056		254,618	34,090	86	1,284		272	2		2	56
9	133,837,039	164,597,030	(b)	266,123	(c)	308	10,281		0	86		21	57
4	9,202,671	212,658,642		235,787	35,308	.....	9,204		0	.....		.....	58
6	29,829,806	132,131,754		258,666	36,896	497	8,755		0	16		7	59
9	11,006,173	142,707,195		222,521	28,521	1,465	12,295		3,482	9		10	60
7	1,815,549	73,271,417		81,789	11,287	5	1,810		0	9		3	61
4	(Q) 5,553,260	53,579,002		66,279	10,140	31	1,932		0	0		7	62
6	3,078,589	67,766,701		82,151	10,343	31	2,332		0	5		14	63
	.....	.....		51,872	6,742	.....	1,887		146	18		10	64
6	19,339,752	50,264,461		42,277	8,929	151	2,049	(M)	4,115	.....	.....	.....	65
0	1,620,247	45,528,040		60,631	7,613	.....	1,713		0	(N)	.....	.....	66
0	13,032,645	58,078,828		94,128	4,014	7	8,720		0	0		2	67
5	28,791,547	57,867,896		105,544	22,347	1,303	13,854	(M)	4,186	(O)	(P)	20	68
0	1,624,496	46,101,255		56,804	9,040	335	1,957		0	3		4	69
8	12,007,042	27,522,807		75,902	9,230	1	1,200	.....		.....	.....	.....	70
8	15,714,455	41,700,617		56,904	9,998	196	3,097	(M)	4,928	(O)	(P)	55	71
1	26,739,389	46,218,274		73,458	13,618	219	3,360	(M)	3,023	(O)	(P)	43	72
3	329,935	.....		0	0	0	1		0	1		1	73
6	.....	3,892,268		0	0	0	0		0	0		5	74
8	1,096,086	43,260,352		58,968	11,449	139	2,265		0	1		5	75
0	.....	38,690,033		37,317	5,708	142	462		0	0		0	76
7	9,695,521	52,374,504		58,214	9,811	114	2,704		0	1		14	77
7	148,400	13,291,365		32,693	5,750	.....	1,432		0	0	.....	.....	78
6	(U) 34,348,643	11,857,724		18,622	3,265	38	1,971		0	2	(o)	6	79
9	5,673,795	3,688,000		0	0	0	0		0	3		3	80
8	5,139,332	26,921,380		31,811	5,719	45	1,704		0	1		9	81
2	40,327,581	9,256,460	(b)	26,171	(c)	(V)	(W) 1,247		0	3		8	82
	.....	.....		28,998	3,454	.....	955		267	1		4	83
	.....	.....		.....	.....	.....	.....		.....	.....	.....	.....	.....
9	29,458,460	202,412,236		266,787	43,125	45	534		0	.....		27	84
2	13,607,606	182,456,927		274,355	47,059	659	17,460		0	4		87	85
0	2,738,768	55,747,830		101,905	19,051	325	5,771		0	20		10	86
2	836,731	69,204,047		37,442	7,284	725	1,753		0	0		7	87
4	.....	42,814,700		47,158	8,231	76	1,910		0	0		9	88
6	1,017,447	41,265,294	(X)	17,458	(X) 4,476	(X) 36	(X) 1,561		0	(X) 3	(X)	14	89
0	.....	21,124,630		53,475	8,481	32	1,887		0	0		2	90
2	1,063,240	29,842,822		47,345	5,658	189	3,387		0	0		13	91
7	3,471,159	20,277,545		26,229	4,404	41	1,674		269	0		12	92
	.....	.....		.....	.....	.....	.....		.....	.....	.....	.....	.....
3	24,136,947	447,174,134		206,631	53,827	561	16,654	(M)	2,847	.....		65	93
6	37,206,925	108,751,827		75,429	15,418	.....	3,860		0	.....	.....	.....	94
0	48,330,407	35,047,236		51,879	8,627	231	3,770		0	0		0	95
0	3,511,449	29,019,631		75,522	11,354	250	3,752		0	0		4	96
0	5,237,800	0		0	0	0	0		0	0		1	97
	.....	.....		12,934	2,671	.....	599		31	1		1	98
1	13,389,392	25,590,600		42,074	10,189	249	2,308	(M)	2,362	0	.....	.....	99
8	834,866	19,711,685		36,289	8,612	46	2,038		0	0		5	100
	.....	.....		.....	.....	.....	.....		.....	.....	.....	.....	.....
1	5,369,869	94,372,964		89,253	20,981	451	7,502		0	5		40	101
8	.....	47,215,197		63,518	10,967	23	6,765		0	0		9	102
1	2,202,138	12,124,957		13,124	4,082	110	735		0	0		2	103
2	.....	43,096,701		26,848	7,969	172	2,065		0	0		8	104
6	25,580	68,591,403		76,411	20,601	514	5,023		0	0		22	105
9	49,276,271	45,869,107		68,712	15,170	318	2,432		0	0		5	106
3	19,127,085	53,963,701		41,435	12,843	208	3,062		0	0		11	107
0	17,069,460	25,005,874		46,447	9,914	91	3,841	(M)	702	(O)	(P)	31	108
8	5,648,779	21,469,528	(aa)	29,234	(c)	(c)	(c)		0	1		2	109
5	.....	19,538,695		53,926	6,923	236	2,261		0	0		2	110
8	15,567,384	29,702,925		38,990	10,606	109	4,572	(M)	1,004	(O)	(P)	2	111
0	.....	16,135,537		31,766	4,228	5	767		0	0		2	112
1	33,890,874	29,916,183		28,873	14,710	213	2,329	(M)	2,096	0		4	113
7	12,808,590	16,033,180		41,042	9,077	20	2,441	(M)	721	(O)	(P)	3	114
	.....	.....		.....	.....	.....	.....		.....	.....	.....	.....	.....
	.....	.....	(j)	51,432	.....	.....	.....		.....	.....	.....	.....	115
2	.....	135,026,740		84,939	12,156	230	3,827		0	0		13	116
6	.....	59,078,433		34,371	5,726	274	2,190		0	0		11	117
2	6,873,862	61,224,195		97,621	15,829	61	6,067		0	1		12	118
5	33,211,277	34,306,569		932	0	[illegible]	171		0	0		1	119
	.....	.....		.....	.....	.....	.....		.....	.....	.....	.....	.....

quehanna Electric Co.

(u) Domestic Power.

(v) Includes 586,886 kw.-hr. used by railway section of Cortland Co.

(w) Brooklyn Edison Co., Inc., also included under New York Edison and Allied Companies omitted from totals for Middle Atlantic States to avoid duplication.

(x) Received from inter-connected companies.

(y) Transferred to allied companies.

(z) Includes auxiliaries and excitation.

(A) Meters serving 1 municipal and 3 railway customers.

(B) Includes Metropolitan Edison Co., New Jersey Power & Light Co., Fleetwood & Kutztown Electric Light, Heat & Power Co. and Maryland Public Service Co.

(C) Includes power.

(D) Included under "commercial lighting."

(E) Includes all energy sales.

(F) Includes 31,117,117 kw.-hr. transferred.

(G) Includes Binghamton Light, Heat & Power Co. and Northern Pennsylvania Power Co.

(H) Company sells power at wholesale only No segregated classification.

(I) Includes municipal pumping, 1,725,095 kw.-hr., 30 customers.

(J) Includes retail power, 95,926,000 kw.-hr., 16,093 customers.

(K) Includes 4,487,494 kw.-hr. sold to 7,707 farm customers.

(L) Includes 94,460,710 kw.-hr. sold to the municipal railway system in the City of Detroit.

(M) Rural.

(N) Deliveries to railway department of company.

(O) Included under "other public utilities."

(P) Includes "electric railways."

(Q) Includes railway department.

(R) Only 1 plant operating regularly.

(S) Gross.

(T) Operated for steam heating business.

(U) Includes 25,536,905 kw.-hr. used by company owned interurban and street railways.

(V) Included under "power."

(W) Includes "municipalities."

(X) Customers reclassified. Not comparable with previous reports.

(Y) Also 304,539 kva. available by lease or contract from 26 sources. Excluding that available from affiliated companies.

(Z) Net; gross generated 201,341,135 kw.-hr.

(aa) Includes also "commercial lighting, municipalities and power."

(bb) Includes 60,525,452 kw.-hr., company railway system.

(cc) Lighting only.

(dd) Includes Yuma Utilities Co. and Nevada-California Power Co.

(ee) Horsepower.

0	0	0	0	0	0	0	0	0	216,859,000	5,237,800	0	0	0
000												12,934	2,671

694,400	3,494,793,739	3,107,850,017	386,943,722									
97	U. S. Government (Muscle Shoals)	0		0	1		230,000	222,096,800	222,096,800		0
98	Kentucky & West Virginia Power Company	1	(a)	19,500	0		0	194,912,000	41,552,000		153,360,000
99	Kentucky Utilities Company	25	(a)	58,167	0		0	194,822,819	124,419,131		70,403,688
100	Memphis Power & Light Company	1	(a)	54,000	0		0	172,781,000	167,211,000		5,570,000
	Totals for section	106		631,719	34		1,122,890	4,456,853,360	3,550,799,474		906,053,886
	West South Central States										
101	Oklahoma Gas & Electric Company	28		180,325	0		0	567,869,411	504,768,794		63,100,617
102	Houston Lighting & Power Company	6	(a)	99,486	0		0	436,633,000	433,714,000		2,919,000
103	Louisiana Power & Light Company	16	(a)	91,668	0		0	390,533,000	330,117,000		60,416,000
104	Texas Electric Service Company	17	(a)	51,422	0		0	381,404,000	301,910,000		79,494,000
105	Texas Power & Light Company	31	(a)	67,584	4	(a)	440	374,563,000	263,754,000		110,809,000
106	New Orleans Public Service, Inc.	3	(a)	112,700	0		0	338,629,000	338,629,000		0
107	Arkansas Power & Light Company	46	(a)	40,410	3	(a)	9,666	259,164,000	77,153,000		182,011,000
108	Public Service Company of Oklahoma	12	(a)	64,945	0		0	224,426,315	197,579,279		26,847,036
109	Gulf States Utilities Company	10	(a)	82,783	0		0	(Z) 191,081,273	(Z) 190,989,773		91,500
110	Dallas Power & Light Company	1	(a)	57,500	0		0	179,165,000	177,127,000		2,038,000
111	West Texas Utilities Company	26	(a)	39,540	0		0	147,963,154	139,462,783		8,500,371
112	Fort Worth Power & Light Company	1	(a)	44,000	0		0	146,749,000	146,090,000		659,000
113	Central Power & Light Company	52	(a)	61,131	5	(a)	4,178	146,744,975	128,361,536		18,383,439
114	Southwestern Gas & Electric Company	21	(a)	51,210	0		0	119,647,273	114,636,293		5,010,980
	Totals for sections	270		1,260,325	12		17,850	3,904,572,401	3,344,292,458		560,279,943
	Mountain States										
115	The Montana Power Company	0		0	11	(a)	210,900	1,583,985,000	1,573,229,000		10,756,000
116	Utah Power & Light Company	4	(a)	37,040	35	(a)	188,847	830,862,000	513,712,000		317,150,000
117	Idaho Power Company	0		0	8	(a)	71,500	506,009,000	475,136,000		30,873,000
118	Public Service Company of Colorado	10	(a)	82,025	9	(a)	33,200	298,387,145	289,374,240		9,012,905
119	Salt River Valley Water Users' Association	0		0	7		64,400	275,550,594	256,398,777		19,151,817
	Totals for section	14		148,800	70		694,400	3,494,793,739	3,107,850,017		386,943,722
	Pacific States										
120	Southern California Edison Company	3		369,955	25		440,000	2,762,459,843	2,728,689,163		33,770,680
121	Pacific Gas & Electric Company	9	(a)	182,375	32	(a)	487,925	2,545,713,564	1,771,262,364		774,451,200
122	The North American Company System (California Group)	7	(a)	83,400	15	(a)	295,905	1,537,851,047	1,335,533,484		202,317,563
123	Puget Sound Power & Light Company	6		33,250	14		148,257	877,953,546	783,003,026		94,950,520
124	The Washington Water Power Company	0		0	9	(a)	188,310	746,709,000	732,307,000		14,402,000
125	City of Los Angeles, Bureau of Power and Light	0		0	5		120,757	639,415,709	235,282,800		404,132,909
126	Portland Electric Power Company	3	(a)	55,000	6	(a)	81,980	549,922,100	543,777,800		6,144,300
127	Hetch Hetchy Water Supply City & County of San Francisco	0		0	2		83,000	528,895,495	528,893,495		2,000
128	The California Oregon Power Company	1		350	11		110,710	441,845,615	441,733,495		112,120
129	City of Seattle, Light and Power Department	1		35,000	2		65,000	307,909,700	296,436,700		11,473,000
130	The Southern Sierras Power Company (*dd*)	3	(ee)	11,600	11	(ee)	93,420	294,781,380	252,786,490		41,994,890
131	Northwestern Electric Company	2	(a)	22,500	1	(a)	12,000	286,820,000	228,510,000		58,310,000
132	Los Angeles Gas & Electric Corporation	2	(a)	148,700	0		0	269,681,600	269,653,102		28,498
133	Pacific Power & Light Company	17	(a)	11,350	5	(a)	35,466	232,877,000	187,289,000		45,588,000
134	City of Tacoma, Light Division, Dept. Pub. Util	1		9,000	2		64,000	208,399,465	208,279,008		120,457
*135	San Diego Consolidated Gas & Electric Company	2		91,000	0		0	153,825,600	148,667,230		5,158,370
	Totals for section	57		1,177,225	140		2,486,424	12,385,060,664	10,692,104,157		1,692,956,507
	Canada										
136	Hydro-Electric Power Commission of Ontario	0		0	22		799,854	4,429,404,096	4,129,765,276		299,638,820
137	The Shawinigan Water & Power Company	0		0	16	(a)	567,666	3,409,717,522	1,971,361,552		1,438,355,970
138	Duke-Price Power Company, Ltd.	0		0	1		363,000	2,096,903,000	2,096,903,000		0
139	Montreal Light, Heat & Power Consolidated	1		16,500	4		223,100	1,450,484,998	1,008,325,115		442,159,883
140	Canadian Hydro-Electric Corporation, Ltd. System	0		0	19		456,855	(r) 1,297,239,606	1,295,204,016		2,035,590
141	Laurentide Power Company, Ltd	0		0	1		148,000	839,676,000	839,676,000		0
142	Winnipeg Electric Company (*ff*)	1		12,000	2		151,000	654,491,510	654,491,510		0
143	Canadian Niagara Power Company, Ltd	0		0	1	(a)	75,000	621,423,800	621,423,800		
144	West Kootenay Power & Light Company, Ltd.	0		0	3		135,000	516,071,474	516,071,474		0
145	City of Winnipeg Hydro-Electric System	1		13,750	1		83,905	400,668,600	388,865,600		11,803,000
146	British Columbia Electric Railway Company, Ltd.	1		12,500	4		123,325	390,564,500	390,564,500		0
147	Canada Northern Power Corporation, Ltd. System	0		0	8		81,375	343,930,010	343,930,010		0
148	Dominion Power & Transmission Company, Ltd.	1		18,000	1	(jj)	45,500	232,656,400	172,502,400		60,154,000
149	Southern Canada Power Company, Ltd.	0		0	5		57,820	146,233,060	141,306,070		4,926,990
	Totals for Canada	5		72,750	88		3,471,734	16,829,464,576	14,570,390,323		2,259,074,253
	Mexico										
150	The Mexican Light & Power Company, Ltd.	3	(rr)	35,100	13		157,960	628,832,675	628,832,675		0
151	Cia. Agricola y de Fuerza Electrica del Rio Conchos	0		0	2		34,950	160,099,800	160,099,800		0
152	Guanajuato Power & Electric Company	0		0	1	(a)	6,100	100,430,000	38,294,000		62,136,000
	Electric Railways										
153	Interborough Rapid Transit Company	2		390,000	0		0	1,177,155,819	1,177,043,930		111,889
154	Chicago Surface Lines	0		0	0		0	(nn) 592,545,223	0	(nn)	649,604,582
155	Williamsburgh Power Plant Corporation (B.M.T.)	2	(a)	204,100	0		0	568,889,703	568,889,703		0
156	Philadelphia Rapid Transit Company	2	(a)	41,275	0		0	377,326,475	49,089,072		328,237,403
157	The Pennsylvania Railroad (L. I. City Gen. Sta.)	1	(a)	87,500	0		0	333,037,210	296,890,210		36,147,000
158	Boston Elevated Railway	5		182,000	0		0	(s) 252,965,140	(s) 252,965,140		0
159	The New York Central Railroad Company	2		110,000	0		0	230,003,185	186,448,185		43,555,000
160	The New York, New Haven & Hartford Railroad Company	1		62,840	0		0	201,191,225	122,130,455		79,060,770
161	Pacific Electric Railway Company	0		0	0		0	184,759,206	0		184,759,206
162	Chicago, Milwaukee, St. Paul & Pacific Railroad Company	0		0	0		0	(oo) 162,274,409	0	(oo)	162,274,409
163	Twin City Rapid Transit Company	1		75,000	2		16,000	135,530,869	59,595,110		75,935,759
164	Kansas City Public Service Company	0		0	0		0	132,306,100	0		132,306,100
165	Norfolk & Western Railway Company	4		52,000	0		0	127,944,156	101,116,614		26,827,542
166	The Connecticut Company	2		35,000	1		700	109,993,477	65,875,280		44,118,197
167	The Virginian Railway Company	1		50,000	0		0	(S) 104,636,000	(S) 104,636,000		0

Nevada-California Power Co.

(*ee*) Horsepower.

0		0	0	0	0		0	0	216,859,000	5,237,800	0	0	0
,000												12,934	2,671
,688		11,781,787	11,334,500	5,558,782	98,639,371	(*M*)	709,686	0	27,818,701	13,389,392	25,590,600	42,074	10,189
,000		16,086,234	40,294,849	5,172,956	40,837,202		0	0	49,843,208	834,866	19,711,685	36,289	8,612
,886													
,617		31,807,479	39,460,144	13,971,506	347,446,201		0	17,760,477	17,680,771	5,369,869	94,372,964	89,253	20,981
,000		25,617,181	18,552,604	20,656,637	253,461,663		0	0	71,129,718		47,215,197	63,518	10,967
,000		3,275,663	3,368,282	2,681,584	131,175,905		0	0	235,704,471	2,202,138	12,124,957	13,124	4,082
,000		12,149,585	12,936,807	6,786,645	134,359,480		0	0	172,074,782		43,096,701	26,848	7,969
,000		29,545,446	19,953,305	22,486,845	194,916,415		0	0	39,044,006	25,580	68,591,403	76,411	20,601
0		29,561,092	26,574,378	12,821,012	117,073,141		0	0	57,453,999	49,276,271	45,869,107	68,712	15,170
,000		13,070,600	19,621,750	8,374,715	121,622,046		0	0	23,384,103	19,127,085	53,963,701	41,435	12,843
,036		17,683,690	15,554,300	6,815,344	81,767,703	(*M*)	190,914	4,863,970	55,475,060	17,069,460	25,005,874	46,447	9,914
,500		8,364,202	9,822,650	4,088,331	104,368,671		0	3,978,584	33,340,528	5,648,779	21,469,528	(*aa*) 29,234	(*c*)
,000		23,119,297	26,060,700	11,600,098	65,424,625		0	0	33,421,585		19,538,695	53,926	6,923
,371		16,995,290	9,378,191	3,933,067	69,118,828	(*M*)	550,933	292,578	2,423,958	15,567,384	29,702,925	38,990	10,606
,000		11,176,377	12,306,518	9,700,169	91,493,399		0	0	5,937,000		16,135,537	31,766	4,228
,439		12,447,645	12,420,532	5,443,578	37,605,328	(*M*)	11,768,324	0	3,252,511	33,890,874	29,916,183	28,873	14,710
,980		12,278,950	18,633,018	5,895,826	44,278,376	(*M*)	278,275	7,746,901	1,694,157	12,808,590	16,033,180	41,042	9,077
,943													
,000												(*j*) 51,432	
,000		37,575,972	36,701,393	12,715,118	557,405,245		0	0	51,437,532		135,026,740	84,939	12,156
,000		30,754,762	13,459,338	9,059,183	67,863,518		0	0	325,793,766		59,078,433	34,371	5,726
,905		33,704,602	45,971,138	9,197,072	122,663,026		0	295,338	18,457,912	6,873,862	61,224,195	97,621	15,829
,817		1,716,430	0	9,759,122	166,447,231		0	0	30,109,965	33,211,277	34,306,569	932	0
,722													
,680		115,990,948	84,217,586	579,555,705	1,044,747,157		53,574,595	302,307,891	32,423,606	11,054,652	538,587,703	325,986	40,797
,200	(*b,cc*)	342,755,284	(*c*)	23,751,234	992,770,770		66,803,328	282,007,592	58,864,538	66,492,629	712,268,189	(*b,cc*) 467,578	(*c*)
,563		36,210,081	106,751,755	6,127,296	848,785,363		42,521,752	28,801,203	55,815,367	5,820,901	407,017,329	92,099	24,133
,520		57,385,203	61,739,464	18,927,428	236,237,803		214,643,353	74,027,659	20,699,560		194,293,076	108,354	17,137
,000												(*j*) 49,946	
,909		78,828,675	130,786,257	0	289,067,658		47,875,187	0	0	7,173,336	85,684,596	203,049	33,109
,300		68,013,731	30,825,273	21,029,626	200,947,378		0	(*bb*) 79,286,031	32,852,318	3,203,810	113,763,933	88,181	8,909
,000		0	0	0	0		0	0	474,562,800	11,147,836	43,184,859	0	0
,120		26,005,686	11,427,727	1,478,078	60,067,245		0	0	257,576,122	3,378,706	81,912,051	16,855	3,561
,000	(*qq*)	74,522,610	52,882,054	11,075,180	62,292,504		(*c*)	37,768,008	95,000	11,164,815	58,109,529	(*qq*) 80,540	9,000
,890	(*cc*)	4,637,426	6,648,294	10,407,346	165,085,533		8,167,098	0	9,687,612	2,126,108	88,021,963	(*cc*) 16,079	4,193
,000		22,288,054	20,825,302	4,047,039	197,227,092		0	0	88,255		42,344,258	21,880	4,366
,498	(*b*)	142,484,730	(*c*)	1,800,838	77,161,018			0	0	4,644,320	43,590,694	(*l,b*) 143,669	(*c*)
,000		37,903,437	16,549,947	5,921,147	82,681,900		0	0	40,868,235		48,952,334	48,645	10,114
,457	(*b*)	66,994,719	(*c*)	12,989,552	73,201,430		0	830,677	10,064,491		44,318,596	(*j*) 37,947	(*c*)
,370		17,893,775	30,497,694	5,093,628	52,065,520		0	17,283,000	378,233	6,736,484	23,877,266	53,263	10,586
,507													
,820													
,970		0	0	0	3,206,846,176		0	0	0	8,327,952	194,543,394	0	0
0		0	0	1,153,114	1,487,186,628		0	0	601,892,905	(*g*)	(*h*) 6,670,353	0	0
,883												(*b*) 219,501	(*c*)
,590		0	0	65,465,013	972,988,713		0	0	159,730,532	59,611,815	39,443,533	0	0
0		0	0	0	193,393,000		47,047,000	0	599,236,000			0	0
0		50,139,108	16,339,043	881,745	353,778,938		44,444,353	45,655,919	21,756,482		121,495,922		
0												(*b*) 2,715	(*c*)
,000	(*gg*)	128,668,450	(*hh*) 75,163,536	709,419	43,512,691		77,566,300	0	4,709,300		70,338,904	(*gg*) 66,115	7,252
0		35,291,400	39,004,054	16,392,393	117,361,369		18,000,000	78,936,769	244,800	6,181,141	79,152,574	63,091	12,445
0	(*cc*)	2,178,463	2,238,784		301,055,425	(*ii*)	2,984,338	1,080,000	0		34,393,000	(*cc*) 7,623	1,551
,000								(*ii*) 20,312,660					
,990		9,551,500	2,950,000	3,021,650	50,560,422		456,250	1,583,180	68,041,585	1,438,740	8,629,733	18,981	3,280
,253													
0		16,196,747	15,303,635	10,995,794	318,687,651		15,654,109	84,443,244	22,762,310	7,468,363	137,320,822	85,990	26,533
0	(*ll*)	6,862,585	(*c*)	(*c*)	132,966,112		0	0	0	2,031,240	18,239,863	(*ll*) 3,922	(*c*)
,000												(*j*) 250	
,889		0	0	20,440	5,499		0	206,833,435	59,356	839,289,480	(*mm*) 130,947,609	0	0
,582		0	0	0	0		0	5,647,440	0	527,643,261	59,254,522	0	0
0		0	0	0	0		0	521,182,446	0		47,707,257	0	0
,403		0	0	0	0		0	0	0	377,326,475		0	0
,000		0	0	0	0		0	0	0	333,037,210		0	0
0													
,000		0	0	0	46,297,870		0	22,275,985	0	158,003,410	3,425,920	0	0
,770		0	0	0	0		0	35,605,626	0	159,068,174	6,517,425	0	0
,206													
,409													
,759													
,100		0	0	0	194,830		0	8,531,516	274,572	112,000,282	11,304,900	0	0
,542		0	0	0	0		0	0	0	127,944,156		0	0
,197													
0		0	0	0	0		0	0	0	91,776,130	(*pp*) 12,859,870	0	0

30,000	222,096,800	222,096,800	0		0	0	0	0		0	0	216,859,000	
0	194,912,000	41,552,000	153,360,000										
0	194,822,819	124,419,131	70,403,688		11,781,787	11,334,500	5,558,782	98,639,371	(M)	709,686	0	27,818,701	1
0	172,781,000	167,211,000	5,570,000		16,086,234	40,294,849	5,172,956	40,837,202		0	0	49,843,208	
22,890	4,456,853,360	3,550,799,474	906,053,886										
0	567,869,411	504,768,794	63,100,617		31,807,479	39,460,144	13,971,506	347,446,201		0	17,760,477	17,680,771	
0	436,633,000	433,714,000	2,919,000		25,617,181	18,552,604	20,656,637	253,461,663		0	0	71,129,718	
0	390,533,000	330,117,000	60,416,000		3,275,663	3,368,282	2,681,584	131,175,905		0	0	235,704,471	
0	381,404,000	301,910,000	79,494,000		12,149,585	12,936,807	6,786,645	134,359,480		0	0	172,074,782	
440	374,563,000	263,754,000	110,809,000		29,545,446	19,953,305	22,486,845	194,916,415		0	0	39,044,006	
0	338,629,000	338,629,000	0		29,561,092	26,574,378	12,821,012	117,073,141		0	0	57,453,999	4
9,666	259,164,000	77,153,000	182,011,000		13,070,600	19,621,750	8,374,715	121,622,046		0	0	23,384,103	1
0	224,426,315	197,579,279	26,847,036		17,683,690	15,554,300	6,815,344	81,767,703	(M)	190,914	4,863,970	55,475,060	1
0	(Z) 191,081,273	(Z) 190,989,773	91,500		8,364,202	9,822,650	4,088,331	104,368,671		0	3,978,584	33,340,528	
0	179,165,000	177,127,000	2,038,000		23,119,297	26,060,700	11,600,098	65,424,625		0	0	33,421,585	
0	147,963,154	139,462,783	8,500,371		16,995,290	9,378,191	3,933,067	69,118,828	(M)	550,933	292,578	2,423,958	1
0	146,749,000	146,090,000	659,000		11,176,377	12,306,518	9,700,169	91,493,399		0	0	5,937,000	
4,178	146,744,975	128,361,536	18,383,439		12,447,645	12,420,532	5,443,578	37,605,328	(M)	11,768,324	0	3,252,511	3
0	119,647,273	114,636,293	5,010,980		12,278,950	18,633,018	5,895,826	44,278,376	(M)	278,275	7,746,901	1,694,157	1
17,850	3,904,572,401	3,344,292,458	560,279,943										
10,900	1,583,985,000	1,573,229,000	10,756,000										
88,847	830,862,000	513,712,000	317,150,000		37,575,972	36,701,393	12,715,118	557,405,245		0	0	51,437,532	
71,500	506,009,000	475,136,000	30,873,000		30,754,762	13,459,338	9,059,183	67,863,518		0	0	325,793,766	
33,200	298,387,145	289,374,240	9,012,905		33,704,602	45,971,138	9,197,072	122,663,026		0	295,338	18,457,912	
64,400	275,550,594	256,398,777	19,151,817		1,716,430	0	9,759,122	166,447,231		0	0	30,109,965	3
94,400	3,494,793,739	3,107,850,017	386,943,722										
40,000	2,762,459,843	2,728,689,163	33,770,680		115,990,948	84,217,586	579,555,705	1,044,747,157		53,574,595	302,307,891	32,423,606	1
87,925	2,545,713,564	1,771,262,364	774,451,200	(b,cc)	342,755,284	(c)	23,751,234	992,770,770		66,803,328	282,007,592	58,864,538	6
95,905	1,537,851,047	1,335,533,484	202,317,563		36,210,081	106,751,755	6,127,296	848,785,363		42,521,752	28,801,203	55,815,367	
48,257	877,953,546	783,003,026	94,950,520		57,385,203	61,739,464	18,927,428	236,237,803		214,643,353	74,027,659	20,699,560	
88,310	746,709,000	732,307,000	14,402,000										
20,757	639,415,709	235,282,800	404,132,909		78,828,675	130,786,257	0	289,067,658		47,875,187	0	0	
81,980	549,922,100	543,777,800	6,144,300		68,013,731	30,825,273	21,029,626	200,947,378		0	(bb) 79,286,031	32,852,318	
83,000	528,895,495	528,893,495	2,000		0	0	0	0		0	0	474,562,800	1
10,710	441,845,615	441,733,495	112,120		26,005,686	11,427,727	1,478,078	60,067,245		0	0	257,576,122	
65,000	307,909,700	296,436,700	11,473,000	(qq)	74,522,610	52,882,054	11,075,180	62,292,504		(c)	37,768,008	95,000	1
93,420	294,781,380	252,786,490	41,994,890	(cc)	4,637,426	6,648,294	10,407,346	165,085,533		8,167,098	0	9,687,612	
12,000	286,820,000	228,510,000	58,310,000		22,288,054	20,825,302	4,047,039	197,227,092		0	0	88,255	
0	269,681,600	269,653,102	28,498	(b)	142,484,730	(c)	1,800,838	77,161,018			0	0	
35,466	232,877,000	187,289,000	45,588,000		37,903,437	16,549,947	5,921,147	82,681,900		0	0	40,868,235	
64,000	208,399,465	208,279,008	120,457	(b)	66,994,719	(c)	12,989,552	73,201,430		0	830,677	10,064,491	
0	153,825,600	148,667,230	5,158,370		17,893,775	30,497,694	5,093,628	52,065,520		0	17,283,000	378,233	
486,424	12,385,060,664	10,692,104,157	1,692,956,507										
799,854	4,429,404,096	4,129,765,276	299,638,820										
567,666	3,409,717,522	1,971,361,552	1,438,355,970		0	0	0	3,206,846,176		0	0	0	
363,000	2,096,903,000	2,096,903,000	0		0	0	1,153,114	1,487,186,628		0	0	601,892,905	
223,100	1,450,484,998	1,008,325,115	442,159,883										
456,855	(r) 1,297,239,606	1,295,204,016	2,035,590		0	0	65,465,013	972,988,713		0	0	159,730,532	5
148,000	839,676,000	839,676,000	0		0	0	0	193,393,000		47,047,000	0	599,236,000	
151,000	654,491,510	654,491,510	0		50,139,108	16,339,043	881,745	353,778,938		44,444,353	45,655,919	21,756,482	
75,000	621,423,800	621,423,800											
135,000	516,071,474	516,071,474	0										
83,905	400,668,600	388,865,600	11,803,000	(gg)	128,668,450	(hh) 75,163,536	709,419	43,512,691		77,566,300	0	4,709,300	
123,325	390,564,500	390,564,500	0		35,291,400	39,004,054	16,392,393	117,361,369		18,000,000	78,936,769	244,800	
81,375	343,930,010	343,930,010	0	(cc)	2,178,463	2,238,784		301,055,425	(ii)	2,984,338	1,080,000	0	
45,500	232,656,400	172,502,400	60,154,000								(ii) 20,312,660		
57,820	146,233,060	141,306,070	4,926,990		9,551,500	2,950,000	3,021,650	50,560,422		456,250	1,583,180	68,041,585	
471,734	16,829,464,576	14,570,390,323	2,259,074,253										
157,960	628,832,675	628,832,675	0		16,196,747	15,303,635	10,995,794	318,687,651		15,654,109	84,443,244	22,762,310	
34,950	160,099,800	160,099,800	0	(ll)	6,862,585	(c)	(c)	132,966,112		0	0	0	
6,100	100,430,000	38,294,000	62,136,000										
0	1,177,155,819	1,177,043,930	111,889		0	0	20,440	5,499		0	206,833,435	59,356	83
0	(nn) 592,545,223	0	(nn) 649,604,582		0	0	0	0		0	5,647,440	0	52
0	568,889,703	568,889,703	0		0	0	0	0		0	521,182,446	0	
0	377,326,475	49,089,072	328,237,403		0	0	0	0		0	0	0	37
0	333,037,210	296,890,210	36,147,000		0	0	0	0		0	0	0	33
0	( ) 252,965,140	( ) 252,965,140	0										
0	230,003,185	186,448,185	43,555,000		0	0	0	46,297,870		0	22,275,985	0	15
0	201,191,225	122,130,455	79,060,770		0	0	0	0		0	35,605,626	0	15
0	184,759,206	0	184,759,206										
0	(oo) 162,274,409	0	(oo) 162,274,409										
16,000	135,530,869	59,595,110	75,935,759										
0	132,306,100	0	132,306,100		0	0	0	194,830		0	8,531,516	274,572	11
0	127,944,156	101,116,614	26,827,542		0	0	0	0		0	0	0	12
700	109,993,477	65,875,280	44,118,197										
0	(S) 104,636,000	(S) 104,636,000	0		0	0	0	0		0	0	0	9

			12,934	2,671		599		31	1		1	98
13,389,392	25,590,600		42,074	10,189	249	2,308	(M)	2,362	0			99
834,866	19,711,685		36,289	8,612	46	2,038		0	0		5	100
5,369,869	94,372,964		89,253	20,981	451	7,502		0	5		40	101
	47,215,197		63,518	10,967	23	6,765		0	0		9	102
2,202,138	12,124,957		13,124	4,082	110	735		0	0		2	103
	43,096,701		26,848	7,969	172	2,065		0	0		8	104
25,580	68,591,403		76,411	20,601	514	5,023		0	0		22	105
49,276,271	45,869,107		68,712	15,170	318	2,432		0	0		5	106
19,127,085	53,963,701		41,435	12,843	208	3,062		0	0		11	107
17,069,460	25,005,874		46,447	9,914	91	3,841	(M)	702	(O)	(P)	31	108
5,648,779	21,469,528	(aa)	29,234	(c)	(c)	(c)		0	1		2	109
	19,538,695		53,926	6,923	236	2,261		0	0		2	110
15,567,384	29,702,925		38,990	10,606	109	4,572	(M)	1,004	(O)	(P)	2	111
	16,135,537		31,766	4,228	5	767		0	0		2	112
33,890,874	29,916,183		28,873	14,710	213	2,329	(M)	2,096	0		4	113
12,808,590	16,033,180		41,042	9,077	20	2,441	(M)	721	(O)	(P)	3	114
		(j)	51,432									115
	135,026,740		84,939	12,156	230	3,827		0	0		13	116
	59,078,433		34,371	5,726	274	2,190		0	0		11	117
6,873,862	61,224,195		97,621	15,829	61	6,067		0	1		12	118
33,211,277	34,306,569		932	0	11	171		0	0		1	119
11,054,652	538,587,703		325,986	40,797	3,051	27,658		16,878	38		7	120
66,492,629	712,268,189	(b,cc)	467,578	(c)	7	40,386		21,306	14		15	121
5,820,901	407,017,329		92,099	24,133	166	22,814		11,202	11		9	122
	194,293,076		108,354	17,137	136	26,326		217	20		8	123
		(j)	49,946									124
7,173,336	85,684,596		203,049	33,109	0	13,090			0		0	125
3,203,810	113,763,933		88,181	8,909	588	2,847		0	8		11	126
11,147,836	43,184,859		0	0	0	0		0	0		1	127
3,378,706	81,912,051		16,855	3,561	64	855		0	0		7	128
11,164,815	58,109,529	(qq)	80,540	9,000	1	2,885		(c)	1		1	129
2,126,108	88,021,963	(cc)	16,079	4,193	105	2,568		3,264	0		6	130
	42,344,258		21,880	4,366	57	1,339		0	0		2	131
4,644,320	43,590,694	(l,b)	143,669	(c)	(l) 160	(l) 7,604			0		0	132
	48,952,334		48,645	10,114	123	4,276		0	0		4	133
	44,318,596	(j)	37,947	(c)	(c)	(c)		0	(c)	(c)		134
6,736,484	23,877,266		53,263	10,586	22	3,999		0	1		3	135
												136
8,327,952	194,543,394		0	0	0	41		0	0		0	137
(g)	(h) 6,670,353		0	0	1	4		0	0		2	138
		(b)	219,501	(c)		5,188						139
59,611,815	39,443,533		0	0				0	0			140
			0	0	0	1		(I)	0		1	141
	121,495,922											142
												143
		(b)	2,715	(c)	5	5					2	144
	70,338,904	(gg)	66,115	7,252	5	1,130		1	0		1	145
6,181,141	79,152,574		63,091	12,445		2,379					1	146
	34,393,000	(cc)	7,623	1,551		300	(ii)	1,500	1		0	147
									(kk)			148
1,438,740	8,629,733		18,981	3,280	100			12	1		3	149
7,468,363	137,320,822		85,990	26,533	553	7,908		13,452	1		3	150
2,031,240	18,239,863	(ll)	3,922	(c)	(c)	422		0	0		0	151
		(j)	250									152
839,289,480	(mm) 130,947,609		0	0				0				153
527,643,261	59,254,522		0	0	0	0		0			0	154
	47,707,257		0	0	0	0		0			0	155
377,326,475			0	0	0	0		0	0		0	156
333,037,210			0	0	0	0		0	0		0	157
												158
158,003,410	3,425,920		0	0	0			0			0	159
159,068,174	6,517,425		0	0	0	0		0	5		0	160
												161
												162
												163
112,000,282	11,304,900		0	0	0			0				164
127,944,156			0	0	0	0		0	0		0	165
												166
91,776,130	(pp) 12,859,870		0	0	0	0		0	0		0	167

(*T*) Operated for steam heating business.

(*U*) Includes 25,536,905 kw.-hr. used by company owned interurban and street railways.

(*V*) Included under "power."

(*W*) Includes "municipalities."

(*X*) Customers reclassified. Not comparable with previous reports.

(*Y*) Also 304,539 kva. available by lease or contract from 26 sources. Excluding that available from affiliated companies.

(*Z*) Net; gross generated 201,341,135 kw.-hr.

(*aa*) Includes also "commercial lighting, municipalities and power."

(*bb*) Includes 60,525,452 kw.-hr., company railway system.

(*cc*) Lighting only.

(*dd*) Includes Yuma Utilities Co. and Nevada-California Power Co.

(*ee*) Horsepower.

(*ff*) Includes Manitoba Power Co., Ltd.

(*gg*) Includes 22,933,708 kw.-hr., 37,215 customers residence lighting, 105,734,742 kw.-hr., 28,900 customers residence heating.

(*hh*) Includes 35,070,896 kw.-hr. commercial lighting, 40,092,640 kw.-hr. commercial heating.

(*ii*) Residential ranges and water heaters.

(*jj*) Including 7,500 kva. frequency changer converting power purchased.

(*kk*) All owned and operated by Dominion Power & Transmission Co., Ltd.

(*ll*) Includes also "commercial lighting and municipalities."

(*mm*) Includes energy used by powerhouses, shops, yards and by substation auxiliaries.

(*nn*) Energy purchased measured on a.c. side, output measured on d.c. side.

(*oo*) Energy consumed.

(*pp*) Includes 4,805,000 kw.-hr. for station use.

(*qq*) Includes "other sales" (heating, etc.).

(*rr*) Also 1 gas plant, 2,800 kva.

(*ss*) Converted a c. measured on d c. side; plus generated d c.

(*tt*) In numerous instances, of which it has not seemed necessary to make individual mention, company reports indicate that figures for "commercial lighting" also include small power sales. Similarly "power" sales include some energy at wholesale for lighting.

(*uu*) A number of companies have included under this heading one or more of the following items: Street Lighting, Municipal, County, State and Federal Buildings, Municipal Power. In some instances energy sold to municipalities for resale is also included.

* See notes (*i*) and (*w*).

formance in so far as *strength* alone was considered.

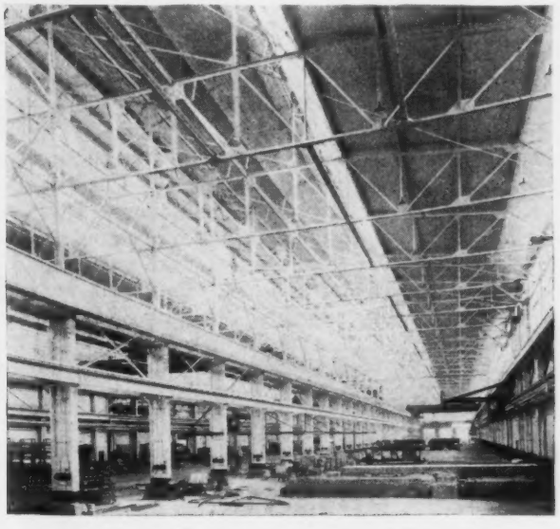
Specimens Nos. 2 and 5 presented more uncertainty and *more difficulties in construction* than either No. 6 or No. 39. In addition, specimen No. 5 permitted a *larger deflection* under horizontal load than that considered desirable.

Specimen No. 6 could be constructed at a *cost slightly less* than No. 39, but it was considered as being *more uncertain* and had the objectionable feature of requiring the hole to be excavated on a slope. If the hole was excavated vertically the horizontal load applied at the top of the footing would become larger, requiring greater strength in the upper part of the stem.

Footing No. 39 was considered as being the *most practical type* and could be constructed for less than *half the cost* of the older standard. It was therefore adopted for the Newark-Morgan Hill tower line. Further study and test data may, however, indicate the advisability of utilizing also a modification of Specimen No. 6, wherein the hole is dug vertically.

Aluminum Paint Improves Shop Illumination

BETTER natural illumination of one of its large foundry buildings, now used for the construction and assembly of domestic electric refrigerators, was realized through the use of aluminum paint at the Erie Works of the General Electric Company without any increase in glass areas or arrangement, the intensity of sources or rearrangement of lighting fixtures. The paint was sprayed on and but one coat was used, this being considered equivalent to two coats of oil paint. The cost as applied was 48 per cent of that of an equivalent pigmented surface, and as refinishing may



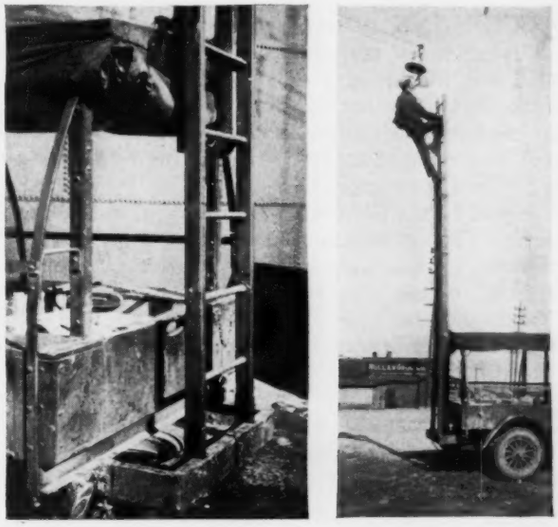
Daylight View of Mill Building Whose Illumination Was Improved by Aluminum Paint

be done at less frequent intervals further savings are possible through both reduced painting costs and minimized interference with production work. The aluminum paint has the added advantage of being highly resistant to the lacquer fumes released in the shop.

Ladder Rig for Maintaining Street Lights

By W. M. Craven
Alabama Power Company, Montgomery, Ala.

A LIGHT ladder rig mounted on a 1-ton service truck has been used to great advantage by the Alabama Power Company in maintaining street lights. This rig is made by hinging one section of a 24-ft. extension



Trucks Equipped with Lamp Servicing Ladder

Foot of extension ladder rests in sockets on truck frame, while other section is hinged to roof

ladder to the rear end of the roof of the truck so the feet of the other section can be set in sockets on an extension to the truck frame when the ladder is in the vertical position. Three metal guides brace the central portion of the extended ladder. The roof of the truck where the hinge is attached is also reinforced with flat iron. All parts which are subject to wear are surfaced with light flat iron. When not in use the ladder rests on the roof of the truck.

With a truck equipped as shown, one man can easily change lamps as well as do the necessary cleaning and maintenance work on fixtures.

Push-Button Protection for Hydraulic Press

FOR the protection of the operators of a large hydraulic embossing press installed at the "Fabrikoid" plant of E. I. du Pont de Nemours & Company, Inc., at Newburgh, N. Y., push-button control which is instantly available from any working position on either side of the press is used. On the feed-in side there are two safety push-button stations which may be locked in the safe position, entirely suspending all operations, while on the other side, the normal position for the operator, are two starting and running push buttons, either one of which may be used for the control of driving motor operation. A limit switch, which prevents damage to the machine through excess pressure application, is included in the pump control system.

This protective scheme has been readily accomplished in

an inexpensive way without undue complexity by installing the push-button stations and safety stations so that all the station "start lines" are in parallel and all the "stop lines" in series and then connecting the wiring directly to the General Electric CR-7051-J1 automatic starting compensator used for the motor control of this press.

Dry Test Developed for Rubber-Insulated Cable

ACCORDING to standard specifications rubber-insulated wires and cables for low tension are to be tested for insulating strength, after twenty-four hours submersion in water of not more than 25 deg. C, for half an hour with alternating current at a suitable voltage. Heretofore this has generally been done by placing the finished conductors in a liquid bath, by which process the liquid forms the outer and the copper core the inner layer. The conductors are then connected to the terminals of the transformer and voltages applied. In addition to weakening the insulating layer this test in a liquid bath has the disadvantage of a great waste of time (immersion in liquid, testing, drying, transportation).

A new dry testing process devised to overcome these difficulties consists in pulling the cable under test through a tube or pipe which contains a series of spring-actuated metal contact spheres that are pressed against the outside of the insulation.

In Fig. 1 is shown the cross-section of a testing electrode containing the section of cable *A*. Small radial tubes contain spheres *K*, which are pressed inward by the springs *F*. The ends of the tubes are constructed to prevent their falling through. Adjustment of the springs is accomplished by slotted plugs in the outer end of the tubes. The spheres, arranged in three rows, are applied spirally so that every point of the surface may be touched, so far as possible. High-voltage alternating current, up to 10,000 volts, is applied between the test-electrode and the conductor core. The voltage is to be

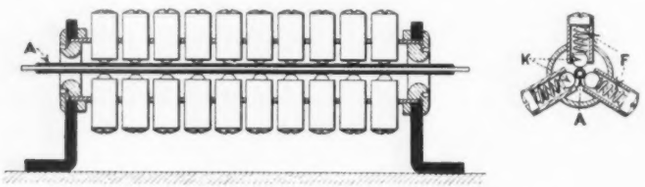


Fig. 1—Spiral Rows of Electrodes Insure Thorough Test of Insulation

sufficiently high to break down an air gap equal to the thickness of the insulation, or to produce ionization in a cavity in the insulation.

The circuits of the entire test apparatus are shown in Fig. 2. Current is supplied through the plug *St* from a socket fused for 6 amp., after the apparatus has been well grounded by way of a ground clamp *E* on the lid. The primary of the multi-tap transformer S_p is thus supplied at 220 volts by way of the double-pole snap switch *Sch*, two single-pole fuses and the four-door closing contacts V_1-V_4. The transformer has taps, so that by changing plugs the applied primary voltage can be made to produce at will secondary voltages of 1,000, 1,500, 2,000, 3,000, 4,000, 5,000, 6,000, 7,000, 8,000, 9,000 and 10,000 volts. The secondary voltage is applied to the primary of the transformer *T* in the high-voltage chamber, by way of the limiting resistance *W*, a double-pole switch *N* with a dead-line release coil and the overload coil of a single-pole switch *M*.

The 220-volt signal lamp *L* glows as long as the high-tension transformer is alive.

The adjustable transformer S_p also has a 45-volt winding connected with the no-load coil of the switch

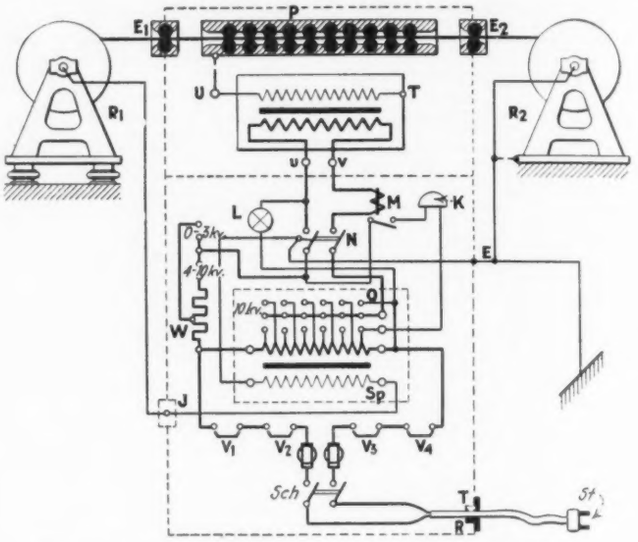


Fig. 2—Test Apparatus as Arranged for 220-Volt Supply

N and thence to the case. The other end of the winding is carried out of the case by way of an insulated building post *J* and is connected with the unwinding drum *R*, which is insulated for 45 volts. The copper core of the wire to be tested is conductively connected on one side with the insulated drum *R* and on the other side with a grounded drum *R*. The drum *R* is connected with the case and the ground clamp *E*, which closes the circuit on the 45-volt winding and therefore causes a current to flow continuously through the cable core. If there is a break in the core the dead-line coil *N* lets go, the double-pole switch opens, the testing transformer loses its voltage and the signal lamp goes out. As soon as the connection is re-established between *R* and *E* the relay automatically closes *N*, the lamp lights up and the apparatus is again ready for continuing the test. The primary current of the transformer *T* also flows through the current coil of the switch *M*. This keeps the circuit closed to the bell *K* by way of the mercury tube as long as a short-circuit on the high-tension side causes a large current to flow. The bell itself is connected to the 22-volt taps of the auto-transformer.

The test itself is carried on in three parts:

1. The wires, after being reeled off from the vulcanizer drum, are drawn through the testing machine, cut into lengths suitable for the braiding machine and sorted into good and defective lengths.

2. In a second apparatus the defective lengths are again pulled through slowly, the faults are found and repaired with quick vulcanizing material.

3. During the insulation test the core of the cable is also tested for breaks.

The cable is fed in through the guide rings, on ball bearings, and through the high-tension electrode *P*.

Excellence Induces Use

The importance of quality in customers' electrical equipment. Discovery of inferiority through adverse experience is costly. Correction at source through organized attention to quality is economical

By Preston S. Millar
General Manager Electrical Testing Laboratories

THERE is reason to feel that inferiority of customers' equipment is greater than is generally realized. A certain amount of inferiority is known to exist because unsatisfactory results force it upon the attention. Absence of complaint is often assumed to indicate that conditions are satisfactory, but it is a fallacious guide regarding equipment which costs but little. The American public often does not take the trouble to report dissatisfaction in small matters. If an appliance is defective or renders an inferior service it is to be feared that in many cases it is merely allowed to fall into disuse.

Electrical appliances sometimes offer an alternative to service which may be rendered by non-electrical equipment. They must excel in convenience or effectiveness if they are to be used largely. Electric cooking, toasting, washing, ironing, heating and refrigerating, for example, are competitive with other means for accomplishing similar results. If electrical appliances for such services are not outstandingly successful they will fall into disuse after being sold and will fail to promote purchase by other householders who become acquainted with their fate.

We are falling short of full realization of the benefits of electric service because of needless inferiority of part of customers' equipment. As a consequence, it is probable that fewer appliances are used and for fewer hours than would be the case if equipment were invariably of high excellence. Things are in demand and are used in proportion to their excellence! Purchase of inferior equipment is usually traceable to lack of knowledge of its inferior qualities. Ignorance of the facts of performance entails such disadvantages as those which are shown in the following:

1. Manufacturers of inferior equipment effect sales which might better go to manufacturers who have a proper concern for excellence.
2. Electric service suffers in reputation. In consequence, the public does not have that definite confidence in electrical appliances which is essential to the best development of electric service.
3. The public's money is spent with less satisfaction. Repeat purchases and collateral purchases which might have been brought about through good performance are not made.
4. The central station does not get the revenue which would accrue if all electrical equipment were of high excellence.
5. Dissatisfaction and complaints are occasioned. Commercial tasks of the electrical industry are rendered more difficult. And public relations are not so good as they might otherwise be.

When Aristotle endeavored to comprehend in a brief list of classified subjects the entire realm of knowledge and being, he found it necessary to make "quality" one of his ten categories. He sought to ascertain quality and to be guided by facts, thereby anticipating modern scientific engineering and establishing himself for all time as one of the world's master intellects.

As for Aristotle—so for the electrical industry. Quality is fundamentally important.

Publicity and Price

Sales often rest largely upon publicity and price. Both are legitimate appeals, potentially of great value for popularizing electric service. When, however, they are utilized without regard to quality they become undesirable. The field is opened to the irresponsible manufacturer and seller who can succeed in a competition based merely upon price and who are aided thereto by much of the publicity for which more responsible manufacturers and merchants pay.

Publicity is an influence of great power. It is a constructive influence when rightly used to promote the sale of meritorious products. It is not used constructively when employed in promotion of sales irrespective of merit. Unless based upon ascertained quality and assured excellence it must seek ideas in realms of lesser reality. For, as Gilbert's ironical expression in Ruddigore has it,

> If you wish in this world to advance
> Your merits you're bound to enhance.
> You must stir it and stump it
> And blow your own trumpet
> Or, trust me, you haven't a chance!

Low-price appliances, as such, are not undesirable. Excellence is desirable at the lowest practicable price. But there is a reasonable minimum of performance excellence and safety below which no inferiority ought to be tolerated. Prices above this low level are justifiable on the grounds of superior performance or serviceability or better appearance or some other quality which will afford an adequate return to the purchaser.

The most able manufacturers ascertain qualities of materials and products with degrees of thoroughness which depend upon their appreciation of the relation of excellence to the success of their business. The best illustration with which I am acquainted of manufacturing practice designed to promote good quality in customers'

equipment is in the case of incandescent lamps, of which more hereafter. In my experience, excellence of fabricated products is generally highest where most pains are taken to ascertain qualities. The manufacturer who observes, measures, records, analyzes and applies results generally makes the best product. It is fortunate for the electrical situation in America that many leading manufacturers seek to achieve and maintain a good reputation for their products through a high degree of excellence.

Less able manufacturers, one suspects, pay attention to these matters only to the extent necessary to effect immediate sales and to avoid rejections and complaints. It is only too true, as Ruskin has said, that

> There is scarcely anything in this world that some man cannot make a little worse and sell a little cheaper.

Merchants and Quality

The merchandising of electrical materials, equipment, and appliances has drifted very largely out of the hands of the electrical industry. Some merchants do and others do not seek to insure excellence of the electrical equipment offered for sale. Few, if any, have the resources to deal effectively with quality even if they desire to do so.

Central Stations and Quality

The operating companies of the electric light and power industry insist upon knowing the quality of the apparatus and equipment upon which the economy and reliability of their service to the public depends. A high standard of excellence is set in all particulars of equipment and operation. These companies exert continuous pressure upon manufacturers to secure ever more efficient, reliable and satisfactory equipment. The combination of progressive, capable electrical manufacturers and operating companies, both ascertaining quality and striving for high excellence, maintains the practice of the American electric power industry at the forefront of progress throughout the world.

However, the organized concern of the light and power companies to ascertain quality and to secure high excellence heretofore has not been carried systematically beyond the electric meters into customers' installations. The equipment with the aid of which the public utilizes electricity has been made and sold without adequate encouragement of superiority and discouragement of inferiority. This lack of intelligent, organized care to insure good electric service has resulted in a distinctly lower order of excellence for applications of electricity than has characterized the equipment for production, distribution and measurement of electric power. Wiring equipment, lighting equipment and electrically heated or motorized appliances often are built to standards of quality much below those they are capable of attaining.

In the early industry electricity was employed almost exclusively for lighting. Electric service could be satisfactory only as incandescent lamps were reliable and effective. Manufacturers and operating companies alike specialized in cultivating lamps for highest excellence. So by tradition and practice the incandescent lamp is the subject of research and testing. As a consequence electric lighting in America is now in advance of that anywhere else in the world. The incandescent lamp forms one of the few exceptions among the customers' electrical equipment in being the recipient of organized, sustained co-operative activities intended to secure high excellence.

Other electrical appliances employed in customers' service are more recent developments. At first the success of the electrical industry did not depend so largely upon the satisfaction which appliances gave the public as it did upon the performance of incandescent lamps. These appliances were not made the subject of the same specialized attention with a view to securing high excellence.

The operating companies, of course, are cognizant of these conditions. Their efforts to combat inferiority in customers' equipment and to mitigate its results usually have taken one or more of four forms:

1. Companies which display and merchandise electrical appliances select brands for the purpose which are believed to be among the best available. Only rarely, however, do they have available information adequate for proper selection of brands.
2. Here and there a light and power company attempts through a testing procedure to insure excellence of the appliances which it sells to the public. Where this is done results are unquestionably better than they otherwise would be, but so far as the situation as a whole is concerned, the influence of such activities is inadequate.
3. Companies which merchandise customers' equipment guarantee replacement if unsatisfactory. This is a good thing to do, but it is only a palliative. There is scant satisfaction to the customer in securing replacement or return of money in case of defect. Confidence in electrical applications is diminished despite replacement.
4. Some companies operate effective servicing departments for the repair or replacement of broken-down appliances. But these services cannot compensate for lack of good design and construction in the first instances. The best way to prevent or to reduce replacements and repairs of customers' equipment is to seek uniformly high excellence in the first instance.

Such measures of amelioration as these are of limited effectiveness under present conditions. Quality often is not well enough understood to permit intelligent selection of brands; investigation of quality by individual companies cannot economically be comprehensive enough for the purpose, and there is a wasteful duplication of expense and effort when individual companies undertake to make their own determinations. Replacement guarantees and repair service assist to combat, but do not materially reduce, inferiority. Finally, such limited effectiveness as these measures afford affects chiefly the better brands, leaving uninfluenced the generality of other equipment which is sold largely through non-electrical dealers.

What Is Needed

Discovery of inferiority through adverse experience is costly and unwholesome. Correction at the source is economical. And this is practicable only through organized attention to quality. When there is lack of intelligent appreciation of excellence the urge to excel is not felt so strongly by producers and sellers. So Lord Lyttleton's "Beauty in the Country" soliloquized pathetically,

> Where none admire 'tis useless to excel,
> Where none are beaux 'tis vain to be a belle.

If the consumers' equipment is to attain to highest practicable excellence and lowest practicable price, it is essential that qualities shall be known. Mr. Hoover has well said:

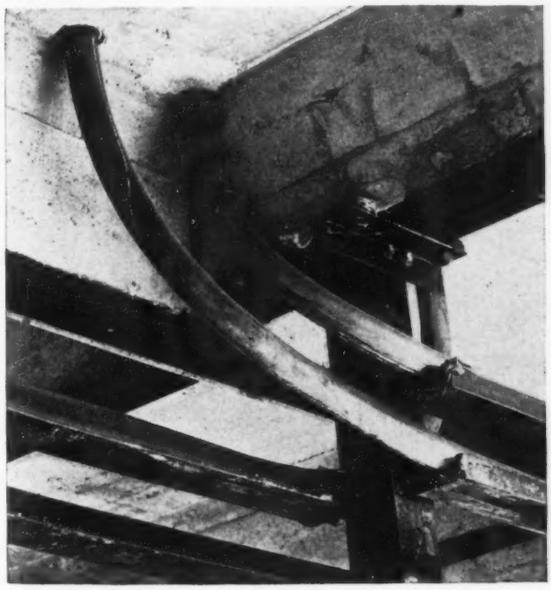
> The first necessity in the handling of problems is the assembling of the facts in their proper perspective.

Aristotle, with limited facilities, sought to ascertain quality and to be guided by facts. The electrical industry, with its highly developed facilities, pursues a like course with respect to equipment used in its own operation. But as concerns customers' equipment, it heretofore has done so only to a limited extent. This condition is now to be remedied. In the autumn of 1928 the Association of Edison Illuminating Companies, in order to meet a

widely recognized need, embarked upon a program of activities designed to improve the quality of customers' electrical equipment. Under the auspices of a committee of member company executives, with Electrical Testing Laboratories as technical and testing agent, it is undertaking to ascertain facts of quality and performance of equipment and appliances, to bring about betterment where practicable, and to use, sell and recommend only thoroughly satisfactory brands and grades. This movement will provide the desired organized attention on the part of large users and may be expected to give an important impetus in the direction of quality improvement for all equipment employed by the public in electric service.

It is the glory of the electrical industry that wherever it goes labor is lightened and life is brightened. But for the fullest practical realization of the ideal of a public well served by a prosperous electrical industry, organized promotion of the highest practicable excellence and the lowest practicable cost for customers' electrical equipment is essential.

Channel Troughs for Cable Supports



IN THE basement of a substation in Winnipeg where it was necessary to run lead-covered cables close under the ceiling standard 3- or 4-in. steel channels were used to support them. These channels are held in position, one above the other, by short lengths of "H" section, bolted to the building steel. Some of the other advantages are non-inflammability, free access of cooling air and ease of installation, according to T. A. Robinson of the Hydro-Electric Commission. Each cable is shielded from those around it. The ease of installation was the most important feature in influencing the decision for channels as the cables could be laid out on the basement floor and then simply lifted into position by men stationed every few feet. This eliminates the pulling-in of cables inside the station. The lead cushions where the cables leave the steel channels prevent chafing of the sheath.

Generator Fire Protection for Automatic Hydro Plant

Thermostats and differential relay control independent water valves, insuring unnecessary flooding of the generator

By E. A. Crellin

Assistant Engineer Division of Hydro-Electric and Transmission Engineering, Pacific Gas & Electric Company, San Francisco, Calif.

ALMOST every conceivable emergency that can arise in an automatic hydro-electric plant has been provided for by suitable relays or similar equipment. Such equipment has proved highly reliable in service and in fact usually functions better than human hands. The equipment for protecting the generator against destruction by fire has not been in such general use as have the various other protective devices, and yet a fire once started in a non-attended plant will probably result in the complete destruction of the generator, if not the entire plant.

It has become standard practice on the system of the Pacific Gas & Electric Company to provide means for flooding the generators with water under penstock pressure in case of fire. The closed system of generator cooling has not been used and CO_2 fire protection is not suited to open ventilating systems. Water seems to be the best fire-fighting medium in such plants. In attended stations or in semi-automatic plants with resident operators responding to an alarm manually controlled fire valves suffice and when properly installed are safe against accidental flooding of the generator.

In an unattended, full-automatic plant, however, reliance must be placed in automatic equipment, and the greatest precautions must be taken against flooding a generator unnecessarily or accidentally and at the same time insure that it will be flooded should occasion demand. An interesting installation has just been completed in Spaulding power house No. 3 which is believed to be unique in several features.

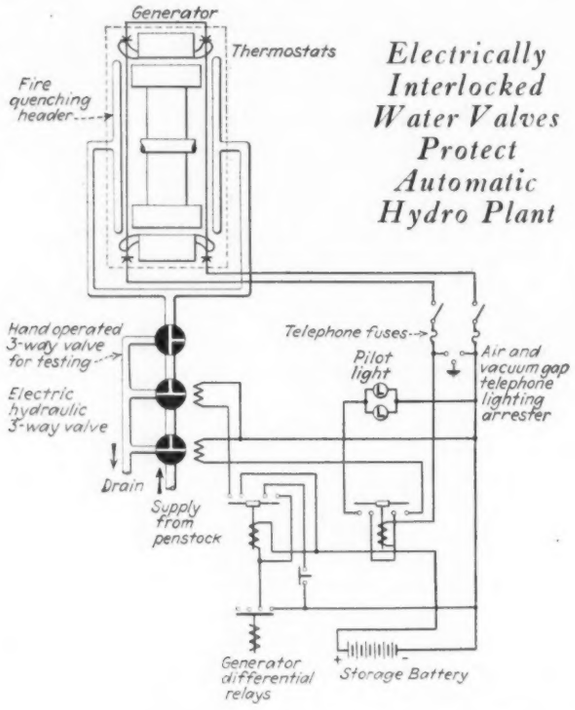
Electrical Interlocking of Valves

To afford maximum insurance against accidental or unnecessary flooding of the generator two valves are installed in series, each receiving its actuating energy from a separate and independent source. Both valve solenoids must be energized before water can be admitted to the generator windings. The first valve is controlled by heat from within the generator and bells. There are 32 quick-acting thermostats of the circuit-opening type, similar to those used in flat-irons, mounted in proximity to the generator windings at intervals around the generator frame. These thermostats are all in series, forming a closed circuit system which will open when any thermostat has been heated to a temperature of 100 deg. C., or the interconnecting wiring has become open circuited from any cause. The thermostat circuit is protected against overvoltage by a pair of telephone fuses and a vacuum and air gap telephone lightning arrester of the type in general use for the protection of power circuit telephone lines.

A two-circuit relay with its contacts open when the relay is energized is in series with the thermostat circuit and the station storage battery. One circuit of the relay completes the circuit through the solenoid of the first

valve when the relay is de-energized and causes the valve to assume position for flooding the generator. The other circuit of the relay completes the circuit through a pair of signal lamps to call attention to the fact that the thermostat circuit has opened and that the fire valve is energized. This is a warning signal to the inspector of trouble in the circuit.

The second valve is controlled from the differential



Electrically Interlocked Water Valves Protect Automatic Hydro Plant

relay protection on the generator. When a differential relay is tripped due to a fault in the generator winding, in addition to the usual function of tripping out all pertinent switches, it completes the circuit through a two-circuit relay which closes its contacts when the relay is energized. One circuit of the relay completes the circuit through the solenoid of the second fire valve when the relay is energized, causing the valve to assume the position for flooding the generator. The other circuit of the relay is a holding circuit to seal the relay in the closed position when it has once been energized. This is necessary because the differential relays are non-hand-reset relays. A push-button switch is connected in the holding circuit for the purpose of tripping the relay after it has operated.

Sequence of Operation

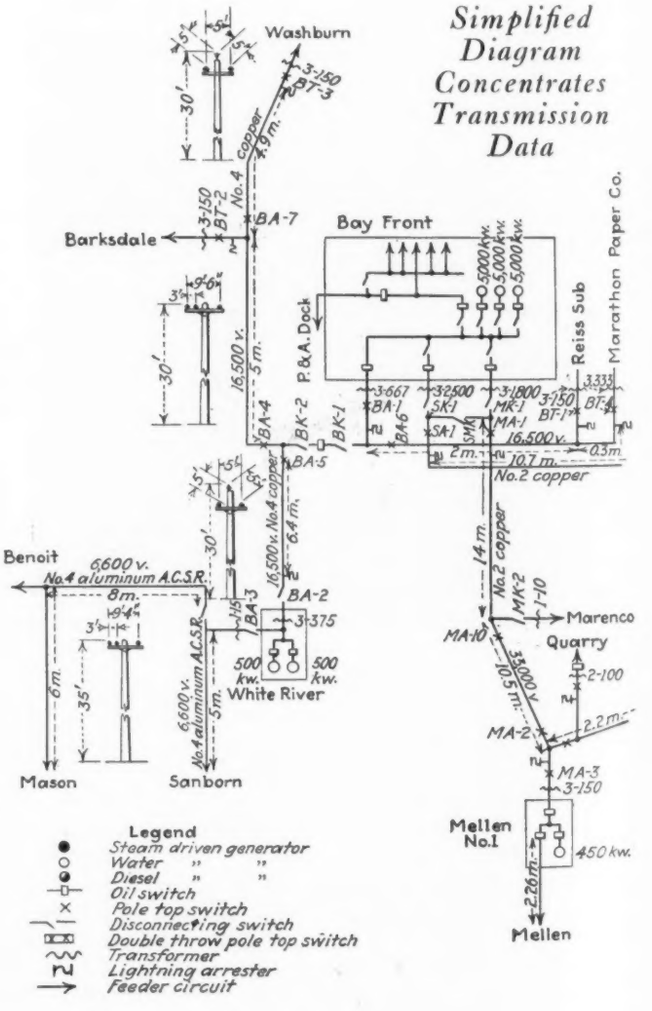
The operation of the system is as follows: If the generator is tripped out by differential relay, one fire valve will be energized and will remain energized until the relay-holding circuit is interrupted by the push-button switch. The generator winding will not be flooded unless a fire follows the differential relay operation and the thermostats are heated to 100 deg. C. As soon as a thermostat is heated sufficiently to cause it to open the circuit, the second valve will be energized and water under penstock pressure will be admitted to the generator winding. This will also cool the thermostat, which will close and shut off the water. If the fire persists, the thermostat will be heated again and a second flooding will occur. This will continue until there is no longer sufficient heat to actuate a thermostat, preventing further flooding.

It is to be noted from the accompanying diagram that one control relay is a circuit-opening relay, the other a circuit-closing relay. This precaution prevents accidental flooding which might occur due to the simultaneous de-energizing of two circuit-opening relays. The integrity of the thermostat circuit is evidenced at all times by the closed circuit connection, the alarm lights at once indicating an open circuit. It is felt that a fire is unlikely to occur from a cause which will not also cause differential relay operation, and therefore the dual system has been chosen as affording the maximum safeguard against accidental flooding.

Everything on the Diagram

THIS portion of the system of the Lake Superior District Power Company, Ashland, Wis., illustrates the manner in which all of the essential information regarding kinds and sizes of equipment, types of line construction, spacing of conductors, lengths of lines, sizes of conductors, etc., are shown on the one print. It is to be noted that the standard symbols for apparatus are accompanied by references by which individual equipment may be identified. R. L. Boisen reports that frequent requests for information, both from within and

Simplified Diagram Concentrates Transmission Data



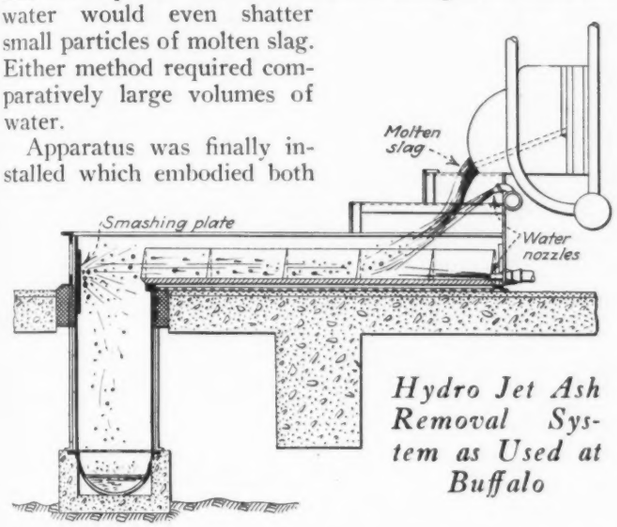
without the company, give value to this kind of map, for on it are shown data that otherwise would have to be compiled from a number of different sources on each occasion.

Molten Ash Removed by Hydro Jets

ASH is removed in the molten condition from the pulverized-fuel boilers of the Charles R. Huntley station in Buffalo by the use of a hydro jet. A number of experiments were conducted before wholly satisfactory results were obtained.

Preliminary tests indicated that the mechanical force of water jets could be used to break up the slag streams into small pieces and that sudden chilling with sufficient water would even shatter small particles of molten slag. Either method required comparatively large volumes of water.

Apparatus was finally installed which embodied both



Hydro Jet Ash Removal System as Used at Buffalo

of these principles of slag disintegration. As shown by the illustration, the molten slag drops onto an apron of water produced by three primary jets. The sudden chill breaks the slag into small pieces, which are caught by two carrier jets below and projected 10 ft. against a cast-iron smashing plate. The collision still further breaks up the particles of slag which fall into a U-shaped trough and are discharged into an outdoor sump about 50 ft. away by two additional carrier nozzles working in tandem near the head of the run. At the discharge end of the chute the slag is deposited in a fine granular condition.

Since the best position for permanent disposal of the ash is 1,000 ft. from the boilers, it was found necessary to pump the mixture from the sump to its destination. This operation is performed by either of two 760-gal.-per-minute manganese-steel pumps, one of which is provided for reserve.

Cast iron was used for the disintegrating chamber, troughs, chutes and discharge pipes. As the slag is highly abrasive, renewable wearing plates were placed in the sluiceways at all right-angle turns and also in the concrete receiving pit to take the direct impingement of the slag-bearing water.

"It is remarkable," reads a statement by the Buffalo General Electric Company in the N.E.L.A. prime movers committee report on the subject, "that this installation, which is the first to be designed for handling molten slag from boiler furnaces by the hydro-jet system, should have proved so successful from the start."

Characteristics of Slag Handled by Hydro Jet

Fusing point of ash, about 1,950 deg. F.	Per Cent
Silica (SiO_2)	44.52
Aluminum oxide (Al_2O_3)	18.64
Iron oxide (Fe_2O_3)	31.35
Titanium oxide (TiO_2)	0.76
Phosphorus pentoxide (P_2O_5)	0.25
Calcium oxide (CaO)	1.33
Magnesium oxide (MgO)	1.10
Sulphur trioxide (SO_3)	1.80
Undetermined	0.25

Salt Water Test Valueless for Rubber Gloves*

By F. M. Farmer
Chief Engineer Electrical Testing Laboratories

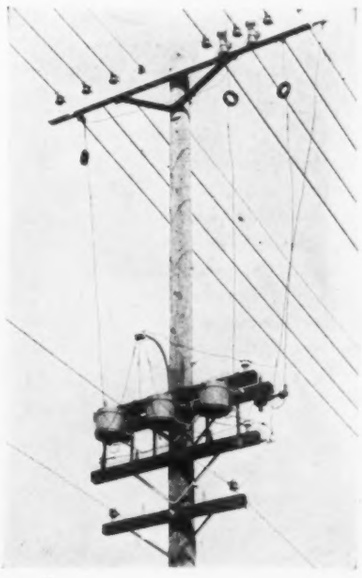
THE idea has prevailed more or less that the water in which rubber gloves are immersed for high-voltage test should be salted in order to develop the maximum leakage current. That this is unnecessary is obvious when it is considered that the impedance of a normal glove is of the order of 1,000,000 ohms and that the power factor is of the order of 2 per cent. A change in the resistance of the circuit of several thousand ohms —far more than that between different kinds of water— is completely masked by the capacitance impedance and cannot have any appreciable effect on the leakage current. The actual measurements, shown in the accompanying table, confirm this contention.

	Current at 10,000 Volts, 60 Cycles (Milliamperes)	
	City Water	Salt Water†
Glove No. 1	6.2	6.2
Glove No. 2	6.6	6.7
Glove No. 3	6.6	6.4
Glove No. 4	7.8	7.8
Glove No. 5	9.2	9.2
Approximate specific resistance of water, ohm-cm	4,000	3.5

†2 per cent salt by weight.

Economical Test-Box Installation

RECENTLY the city of Winnipeg departed from its usual practice of installing three 5-kva. transformers at feeder test installations and now utilizes three 500-watt, 2,000/100-volt outdoor type potential transformers. According to T. A. Robinson of the Hydro-Electric Commission the secondaries of these transformers run down the pole in iron conduit to a weatherproof metal box, large enough to hold a recording voltmeter and a 250-watt heating element for winter use. The leads terminate in a three-pole fused switch, to which the short voltmeter leads are clipped. The phasing of the switch is always *A*, *B* and *C* looking toward the back of the box. There are 29 test locations on the system with about eight voltmeters, which are moved from location to location. Each feeder is tested for two weeks once every two months.



*Prepared at request of National Safety Council.

Long Beach

Complete plant record given from time throttle was opened. Six months' operation shows unusually high sustained economy

Probably no steam plant in America has shown the remarkable performance record of Long Beach steam plant No. 3 of the Southern California Edison Company. For a period of six months and eleven days after the throttle was first opened the plant has shown an average B.t.u. rate of 13,081 B.t.u. per net kilowatt-hour.. Some of the factors contributing to this high economy are:

High extraction cycle efficiency.
Large size of unit.
Efficiency characteristic of plant increases with load.
Complete automatic control.
Unit available high percentage of time.
Constant scrutiny of instrument records.
Low condenser leakage.
Completely inclosed water-cooled furnaces.
Feed water heaters connected under all load conditions.
High quality of feed water.

AVERAGING 13,081 B.t.u. per net kilowatt-hour since the day the plant was started, the first 100,000-kw. unit in Long Beach steam plant No. 3 of the Southern California Edison Company completed six months and eleven days of operation on December 31, last. To use the Pacific Coast measuring stick, the average station economy was 477.81 net kilowatt-hours per barrel of oil.

The first unit of this station, known as unit 10, was described in the October 6, 1928, issue of ELECTRICAL WORLD. The manufacturer's rating of the main generator is 90,000 kw., but this rating has been changed on the company's operating schedule to 100,000 kw. because the unit demonstrated its ability to carry sustained net loads in excess of 100,000 kw. The data which are given in this article, therefore, are all referred to the 100,000-kw. net rating.

The turbine is tandem-compound, with eighteen stages in the high-pressure element and three stages, double flow, in the low-pressure element. The unit consists of the turbine, the main generator, the auxiliary power generator and the auxiliary generator exciter. All of these elements are mounted on shafts which are connected end to end with rigid couplings, making in effect one continuous shaft 93 ft. 2 in. long. The exciter for the main generator is a separate unit with both motor and steam-turbine drive.

The turbine is served by four vertical, single-pass condensers with reheat hotwells. Feed water is heated by heaters using steam extracted from the fifth, tenth, fourteenth and eighteenth stages of the high-pressure turbine. The generator is a double-wound machine rated at 16,500 volts, 1,500 r.p.m., 50 cycles.

The net kilowatt-hour daily output for every day of the six months and eleven days period considered in this article is given in Fig. 2. During this period unit 10 operated 3,638 hours with a net output of 276,104,880 kw.-hr. The total fuel used during this period was 577,858 bbl. of fuel oil or equivalent natural gas. From the operating summary table it will be noted that the month of December is the best of any month of the period. The best day during the entire period was December 12, on which day the net output was 2,318,250 kw.-hr., or an average net load of 96,600 kw. The average economy for this day was 12,806 B.t.u. per net kilowatt-hour.

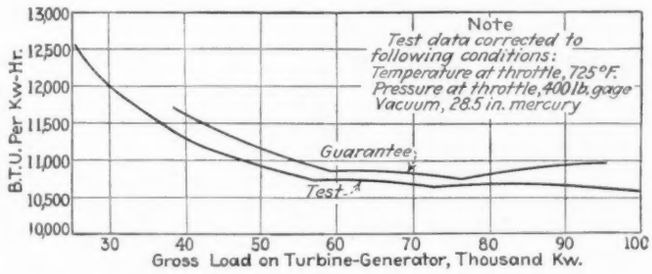


Fig. 1—Guaranteed and Test B.t.u. Rate of Turbo-Generator and Feed Water Heating

The results of numerous test runs on the turbo-generator have been gratifying. The efficiency of the complete unit was guaranteed by the manufacturer on the basis of the net heat input in B.t.u. The net B.t.u. per gross kilowatt-hour was defined as the difference

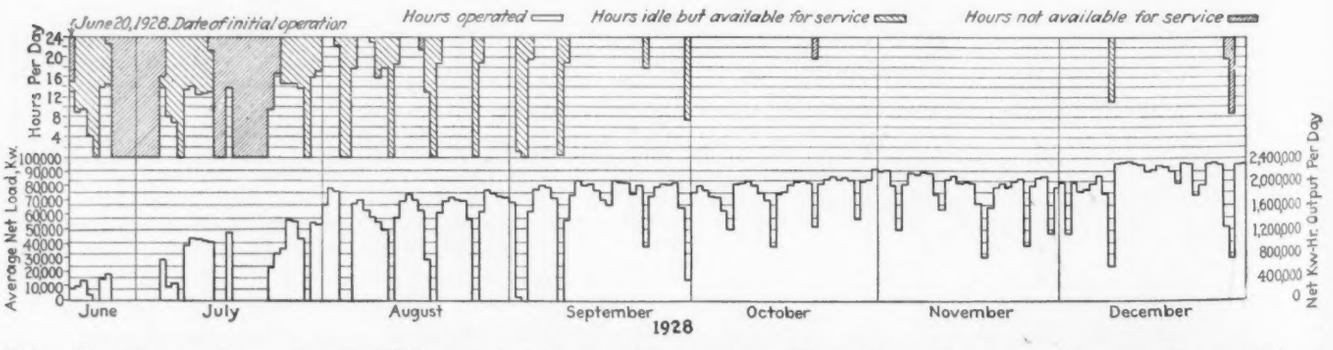


Fig. 2—Operation, Availability and Output Curves for Unit No. 10, Long Beach Steam Plant

Performance

By F. G. PHILO

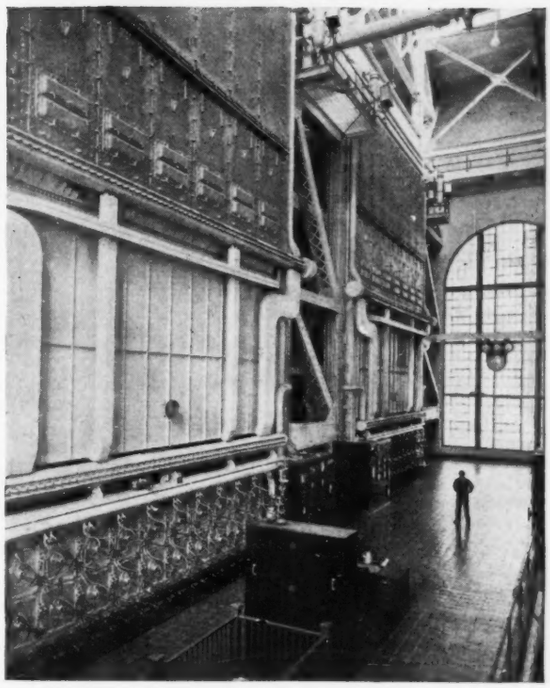
Superintendent
Steam Power Generation
Southern California Edison Company,
Los Angeles, Calif.

between the heat in the steam flowing to the throttle and the heat in the feed water leaving the fifth stage, or last heater in the heating system, divided by the gross kilowatt-hours. The manufacturer's guarantee curve and a similar curve which was plotted from results of test runs and corrected to guarantee conditions are given in Fig. 1.

Output-economy characteristics during the period herein reported are shown in Fig. 3. The curves shown are the net kilowatt-hour output per barrel of fuel oil or equivalent gas and the B.t.u. per net kilowatt-hour output for all loads within the normal operating range of the unit. The straight line is the barrels of fuel oil or equivalent gas used per day for the total net kilowatt-hours per day output of the unit.

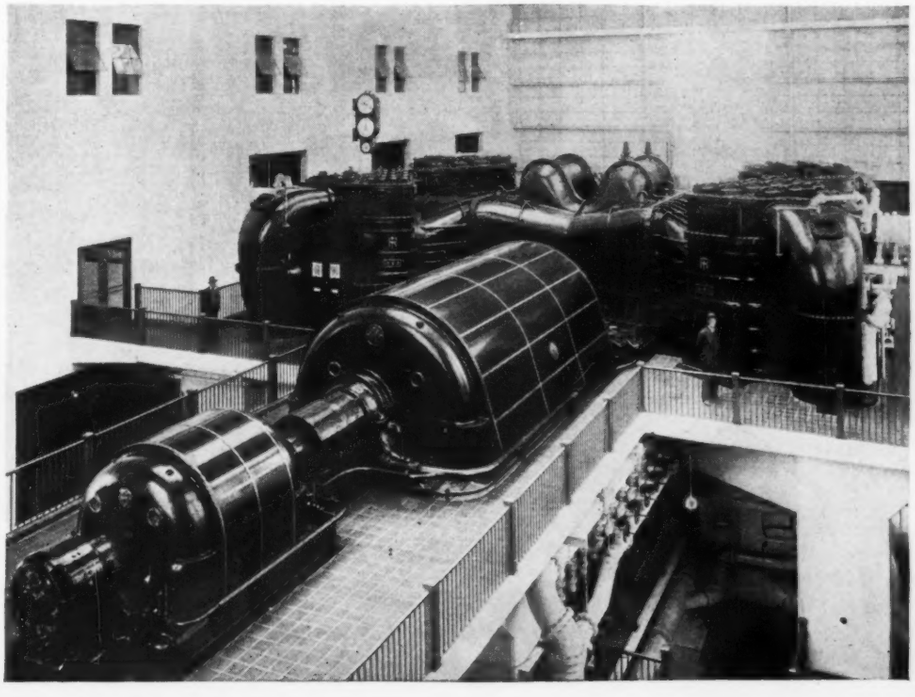
No exhaustive condenser tests have been made, but the vacua obtained at different loads and cooling water temperatures correspond closely to the predicted vacua. There are four sets of primary air removal steam jets serving the four condensers and one set of secondary steam jets discharging through an after-condenser to atmosphere.

The vents from the higher pressure heaters are cascaded to the second stage air removal jets and the vent from the lowest pressure heater is into the condenser. An air flow meter measures the volume of air and gases removed from the entire system. One of the agreeable surprises of the job has been the small amount of air leakage into the condensers, pumps, heaters and piping under vacuum. The amount of air and gases discharged from the system has averaged 3.5 cu.ft. per minute.



Firing Aisle and Two of the Three 34,162-Sq.Ft. Boilers in Latest Addition

The boilers stand 55 ft. above the firing floor and are 67 ft. over all in height. Centralized gage and control boards, wide firing aisle and neatness and cleanliness are features of the boiler room.



Generator and Turbine in Long Beach Steam Plant No. 2

The nominal rating of the main generator is 90,000 kw. and the auxiliary generator 4,000 kw. The horizontal exhaust into the vertical condensers is clearly shown.

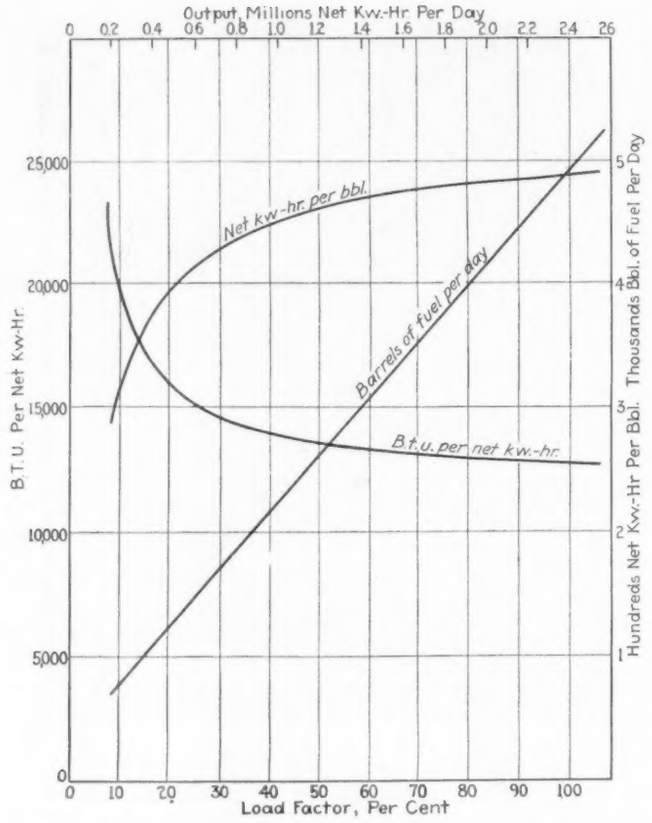

Output, Millions Net Kw.-Hr. Per Day
0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6
B.T.U. Per Net Kw-Hr.
25,000
20,000
15,000
10,000
5,000
0
Net kw.-hr. per bbl.
Barrels of fuel per day
B.t.u. per net kw.-hr.
Hundreds Net Kw.-Hr Per Bbl. Thousands Bbl. of Fuel Per Day
0 10 20 30 40 50 60 70 80 90 100
Load Factor, Per Cent

Fig. 3—Output-Economy Characteristics of 100,000-Kw. Turbo-Generator

The condensers also have proved remarkably tight against leakage of cooling water into the condensate. The condenser tubes are rolled into the tube sheet on the inlet end and packed with metallic packing and fiber rings retained by ferrules on the outlet end. Except for one split tube, there have been no leaks during the period of operation. Electric salinity recorders and chemical laboratory tests all fail to indicate any condenser leakage to contaminate the water.

Feed water quality is watched very closely at Long Beach. Analyses are made daily in the laboratory of samples of water taken from each boiler in service. Make-up water, which averages less than 1 per cent of the total evaporation, is added as evaporator vapor after passing through a scrubber. The evaporators are equipped with a continuous blow-down system by means of which the concentration in the evaporator shells is maintained below 50 grains per gallon. The total solids in the make-up do not exceed one grain per gallon of water added.

The simplified flow diagram of Fig. 4 shows the temperatures that obtain at a gross load of 95,000 kw. on the unit. The extraction feed water heaters are connected to the turbine under all load conditions, permitting the temperature of the entire system to vary with load, from no load to maximum load, without the manipulation of any valves. By-passes permit the withdrawal of any heater from service.

The turbine throttle of unit 10 was first opened for operation on June 20, 1928. The only previous operation of the machine was turning over to dry out the generator. The entire plant went into operation with surprisingly few difficulties. It has been necessary to make but few changes and they have been of a minor nature.

Boiler Performance

The boiler, water-cooled furnace and air heater performance was somewhat better than predicted. There are three boilers of the cross-drum, straight tube type, each with 34,164 sq.ft. of heating surface. At the present time there is no spare boiler. The furnace is completely inclosed with water-cooled walls constructed of refractory-faced, cast-iron blocks cemented to the water-cooled tubes. The furnace column is 19,800 cu.ft., of which about 14,000 cu.ft. is above the lower row of burners, the lower portion forming a hopper for ash removal for future possible operation with coal for fuel. The water-cooled furnace walls have a surface of 3,240 sq.ft. exposed to the radiant heat of the furnace. The boilers operate normally at about 350,000 lb. of steam per hour, which is about 322 per cent of rating, but have been operated as high as 425,000 lb. of steam per hour, or about 395 per cent of rating.

The steam temperature realized was not as high as anticipated. The superheater is of the three-pass, convection type, located in an interdeck position. All of the superheating surface was not installed at the time the boilers were erected, but the omitted tubes will be installed as soon as the boilers can be released for that purpose. It is hoped that when the complete superheater is in operation the guaranteed steam temperature of 750 deg. F. will be realized. This additional superheat will improve the station economy about 12 kw.-hr. per barrel of oil.

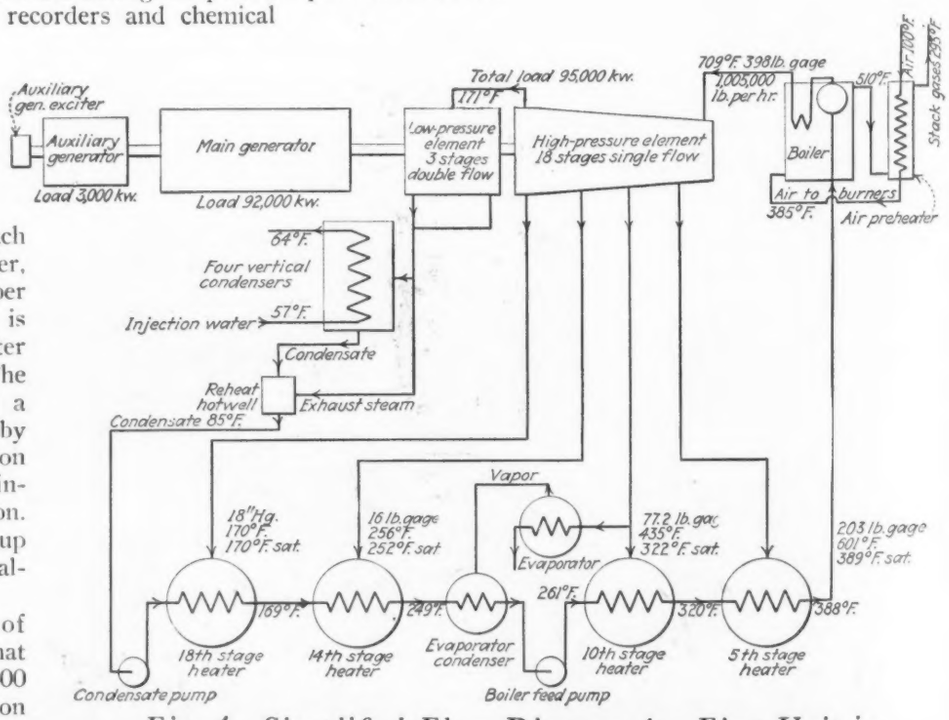


Fig. 4—Simplified Flow Diagram for First Unit in Long Beach Steam Plant No. 3

Table I—Operation Summary for 1928, Unit No. 10, Long Beach Steam Plant No. 3 Southern California Edison Company

	June	July	August	September	October	November	December	Average for Period
Gross kw.-hr.	1,814,200	16,268,700	41,870,400	47,603,800	57,995,900	56,743,200	63,437,000	*285,733,200
Auxiliary kw.-hr.	161,500	583,500	1,402,900	1,578,100	1,899,850	1,919,960	2,082,510	*9,628,320
Net kw.-hr. output	1,652,700	15,685,200	40,467,500	46,025,700	56,096,050	54,823,240	61,354,490	*276,104,880
Aux. percentage of gross	8.90	3.59	3.35	3.32	3.27	3.38	3.28	3.37
Machine load factor 90,000 kw. rating	7.33	23.42	60.44	71.03	83.78	84.60	91.63	65.74
Machine load factor 100,000 kw. rating	6.59	21.08	54.39	63.92	75.40	76.14	82.46	59.17
Net kw.-hr. per barrel of oil	382.92	464.75	478.76	476.86	479.52	478.71	482.18	477.81
B.t.u. per net kw.-hr	16,322	13,448	13,055	13,106	13,034	13,056	12,962	13,081
B.t.u. per gross kw.-hr. turbo-generator extraction cycle	11,121	10,876	10,681	10,503	10,374	10,405	10,497	10,447
Boiler efficiency	74.86	84.46	84.57	82.90	82.27	82.48	83.73	82.69
Steam pressure at throttle	409	404	403	409	402	400	401	404
Steam temperature at throttle	661	688	693	682	682	687	707	689
Feed water temperature	298	354	357	366	378	376	395	375.5
Injection water temperature	65.6	66.3	67.2	64.6	63.3	60.4	57.9	63.6
Vacuum referred to 30 in. Hg. barometer	28.94	28.73	28.77	28.78	28.64	28.68	28.46	28.71

*Total for period.

It will readily be seen from the average boiler efficiency of 82.17 per cent, as reported in the operation summary table, that the 13,000 B.t.u. per net kilowatt-hour over all economy of Long Beach steam plant No. 3 is not due to the use of natural gas and oil fuels, but to a high steam cycle efficiency. Gas has been by far the predominating fuel, as only about 1,000 bbl. of oil has been used. Steam temperatures obtained with gas fuel are somewhat better than the temperatures obtained when burning oil, but over-all boiler efficiencies several per cent better can be obtained with oil than can be obtained with gas. Eastern plants actually obtain better boiler efficiencies with coal than can be realized with natural gas fuel, because of the very high hydrogen losses with gas. Auxiliary power, when using coal, is higher than at Long Beach, but the better boiler room efficiency with modern coal-burning equipment more than offsets the additional auxiliary power required for handling and pulverizing coal.

Complete automatic combustion control, operating on the steam-flow-air-flow relation and actuated by steam pressure, is used. Automatic control of feed water pressure to maintain constant differential between feed water and steam pressures is by means of variable speed motors driving the boiler feed pumps. System frequency is controlled to maintain standard time within two seconds fast or slow, by means of automatic turbine speed regulation.

Table II—Extraction Steam Conditions, Unit No. 10, at Gross Load of 95,000 Kw.

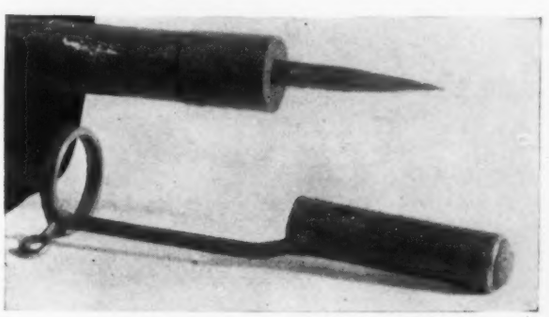
	Eighteenth Stage	Fourteenth Stage	Tenth Stage	Fifth Stage
Gage pressure	18 in. Hg. vacuum	16 lb.	72.2 lb.	203.0 lb.
Saturated steam temperature, deg. F	170	252	322	389
Total temperature of extracted steam, deg. F	170	256	435	601

The various forms of automatic control used make possible the operation of this 100,000-kw. unit with nine operators on duty on each shift. When the second 100,000-kw. unit is installed only five additional operators on each shift will be required, or a total of fourteen men per shift to operate a 200,000-kw. power station. The station maintenance forces, slightly augmented, and practically the same supervisory organization that was required for the operation of plants No. 1 and No. 2, located on the same property, are able to take care of the new plant.

Including this first unit in the No. 3 plant, the total generating capacity of the group of steam plants at Long Beach is now 315,000 kw. The No. 1 plant, maintained as a cold standby, was operated for a few days only in 1928 during the emergency created by the St. Francis Dam disaster. The capacity of the No. 1 plant is 70,000 kw., the No. 2 plant 145,000 kw. and the No. 3 plant, with its first unit, 100,000 kw. Total output from all three plants during the year 1928 was 658,709,170 net kilowatt-hours and the combined economy for all three plants for the year was 15,733 B.t.u. per net kilowatt-hour or 397.26 net kilowatt-hours barrel of oil or equivalent gas.

With a total output of 2,762,459,843 kw.-hr. during 1928 the system of the Southern California Edison Company, serving a territory covering 55,000 square miles of southern California, is now the fourth in annual output of electrical energy in the United States. The total installed generator capacity is 800,740 kw., of which 361,600 kw. is steam capacity and 439,140 kw. hydro capacity. This year a second unit of 30,000 kw. capacity will be added to power house No. 8 of the Big Creek system. With the installation of the second unit in Long Beach steam plant No. 3 in 1930 another 100,000 kw. of steam capacity will have been added, making the steam generating capacity then 49.6 per cent of the total 935,740 kw. planned to be in operation in 1930.

Cap the Pikes for Safety



THE steel points of pike poles carried on a line truck may readily constitute a distinct menace to the safety of members of the crew. To eliminate this hazard the pikes used by the line crews of the Dayton (Ohio) Power & Light Company are capped when not in use. The cap consists of a piece of pipe corked with a wood plug and with a hodling ring arm welded on it. The cap is readily shipped over the pike and will not dislodge easily.

100,000,000-Kw.-Hr. Systems

134 power systems in the United States exceeded this output in 1928. They generated 72,826,693,215 kw.-hr. and added 11,388,254,888 kw.-hr. by purchase

AGAIN ELECTRICAL WORLD'S annual survey of systems having an annual output of 100,000,000 kw.-hr. reveals growth in output of individual companies as compared with former years, the elimination of some names by virtue of consolidations recently effected and the addition of others that for the first time are entitled to be listed. The present survey covers operations for the calendar year 1928. The returns, by systems, are tabulated in detail in the supplement accompanying this issue, to the extent of nearly 8,500 items. One side of this supplement shows the output for each system in 1928 and comparable figures for earlier years where available. On the other side the output for the last year is broken down into energy generated and energy secured by purchase. So far as is known, the list is complete, including every utility system on the continent that had the specified output.

As formerly, the practice has been followed of listing as a unit any system operating as a single physical entity, although commercially it might embrace more than one company. This has kept down the number of names and has given a better idea of the magnitude of the operations.

Of these systems 134 are light and power systems in the United States, 14 in Canada and 3 in Mexico. In addition, there are 15 railroads or railways. The group first mentioned operates 920 fuel-burning and 666 hydro plants, or a total of 1,586 plants. The aggregate rating of the fuel-using plants is 20,120,166 kva. and of the hydro plants 8,326,869 kva., giving a total of 28,447,035 kva.

Some reports are in kilowatts, others in kilovolt-amperes. To reduce them to a common basis 80 per cent power factor is assumed. These plants generated 72,826,693,215 kw.-hr. and 11,388,254,888 kw.-hr. was added by purchase, making a total output of 84,214,948,103 kw.-hr. Since the energy generated by all electric light and power companies was more than 83,000,000,000 kw.-hr. it appears that the output of these larger systems, including purchased energy and therefore involving duplication, did not greatly differ from the energy production of all companies, without the duplication.

In 1927 the 124 major light and power systems in the United States then listed generated 64,380,010,246 kw.-hr. and purchased 9,227,208,954 kw.-hr. The total output was 73,607,219,200 kw.-hr. The plant rating was 24,275,311 kva. In 1926 there were 126 systems, generating 58,073,674,401 kw.-hr. in plants with 22,559,063 kva. In comparing these figures the addition of new names must be borne in mind, as well as the loss of old ones. The latter are shown in detail in footnotes accompanying the large tables. The new ones will be evident from a comparison with the corresponding supplement to the ELECTRICAL WORLD of May 5, 1928.

The Buffalo, Niagara & Eastern is again at the top, with 4,832,459,513 kw.-hr. The inclusion, for the first time, of operations of the Brooklyn Edison Company in the returns of the New York Edison brings the latter to second place, with 4,210,700,000 kw.-hr., followed closely by the Commonwealth Edison, with 4,174,661,000 kw.-hr. The plant capacities reported for these three systems are, respectively, 805,000 kw., 1,474,200 kw. and 1,104,500 kw.

Of the total power plant rating in use by all these large systems 28.3 per cent is credited to the Middle Atlantic States and 23.4 per cent to the East North Central States, 12.9 per cent is in the three Pacific Coast States, where water power outweighs fuel plant capacity more than two to one. The outputs, by regions, require some explanation. Some systems are not confined to a single one of the nine geographical divisions of the country recognized by the Bureau of the Census and the U. S. Geological Survey. To allocate their operations among several regions was impracticable. They were therefore assigned to the region that contained the major part of their operations. Therefore certain sections are somewhat overloaded; thus, all the Southeastern Power & Light Company had to be assigned to the East South Central Division, though about 40 per cent of it is in the South Atlantic.

The output of Canadian systems continues to grow.

Generator Rating and Output of Systems Reporting More than 100,000,000 Kw.-Hr. During 1928

(Summary of detailed tablulation in the supplement of this issue of the ELECTRICAL WORLD)

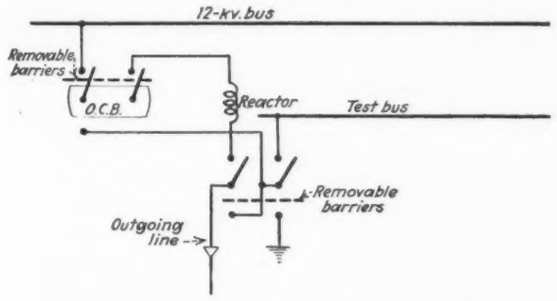
Section	Number of Companies or Systems	Number of Generating Plants and Generator Rating — All Plants — No.	All Plants — Rating, Kva.	Fuel Burning — No.	Fuel Burning — Rating, Kva.	Hydro-Electric — No.	Hydro-Electric — Rating, Kva.	Energy Generated, Kw.-Hr.	Energy Purchased, Kw.-Hr.	Total Energy Output, Kw.-Hr.
United States	134	1,586	28,447,035	920	20,120,166	666	8,326,869	72,826,693,215	11,388,254,888	84,214,948,103
New England	14	77	1,790,884	26	1,375,929	51	414,955	3,882,979,246	894,608,644	4,777,587,890
Middle Atlantic	25	233	8,041,611	114	6,211,265	119	1,830,346	20,862,816,254	3,319,831,663	24,182,647,917
South Atlantic	12	170	2,581,406	94	1,643,248	76	938,158	5,421,568,933	843,053,019	6,264,621,952
East North Central	31	302	6,646,872	182	6,292,757	120	354,115	17,459,411,737	2,696,213,303	20,155,625,040
West North Central	9	101	1,846,629	57	1,378,898	44	467,731	4,504,870,939	88,314,201	4,593,185,140
East South Central	8	140	1,754,609	106	631,719	34	1,122,890	3,550,799,474	906,053,886	4,456,853,360
West South Central	14	282	1,278,175	270	1,260,325	12	17,850	3,344,292,458	560,279,943	3,904,572,401
Mountain	5	84	843,200	14	148,800	70	694,400	3,107,850,017	386,943,722	3,494,793,739
Pacific	16	197	3,663,649	57	1,177,225	140	2,486,424	10,692,104,157	1,692,956,507	12,385,060,664

This time they generated 14,570,390,323 kw.-hr. and purchased 2,259,074,253 kw.-hr. The previous year they generated 11,895,292,334 kw.-hr. and purchased 2,491,-824,655 kw.-hr. In 1926 the total output was 9,594,984,-322 kw.-hr. One system that appeared in previous lists was forced to drop its output below 100,000,000 kw.-hr. in 1928 because of the shutting down of a single large consumer. To preserve the record, and on the assumption that the condition is temporary, its 1928 output is given, but, of course, not counted.

Mexico appears with three names. Both Canada and Mexico are predominantly water power countries. The former has 3,471,734 kva. in hydro in its large systems and only 72,750 kva. in steam. Our southern neighbor's three largest companies have 200,540 kva. in hydro and 35,100 kva. in fuel-burning plants.

Removable Barriers Protect Station Employees

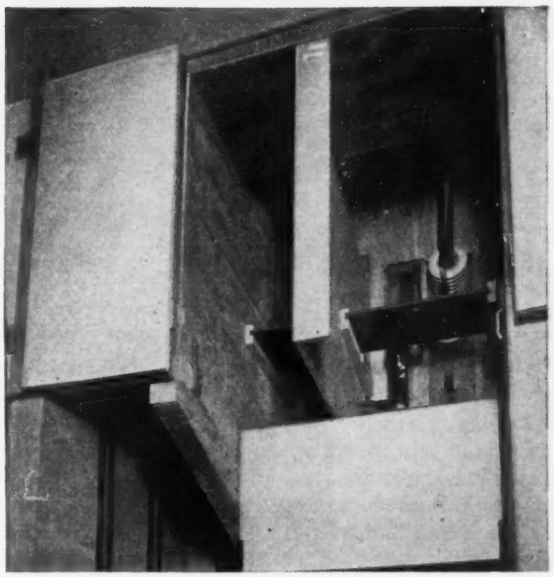
OUTGOING lines from the 12-kv. bus at the new Washington Park bulk power substation of the Commonwealth Edison Company are equipped and arranged so that tests can be made with ease and safety. This substation is fed at 66 kv. and sends out energy at 12 kv. to the distribution substations in its supply area. Each line is equipped with a 600-amp. oil circuit breaker and four disconnecting switches, three of which are double throw. The breaker disconnecting switches are mounted directly on the oil circuit breaker, while the two others are on the floor below. With this arrangement of



Arrangement of Outgoing Lines to 12-Kv. Bus at Washington Park Substation

switches it is possible to put the line or the oil circuit breaker, or both, on either the test bus or ground.

All disconnecting switch cubicles are furnished with side slots in which ebony asbestos boards may be inserted. In the cases of the breaker disconnecting switches these barriers are measures taken for safety only. They are not normally in position, but hang on the barrier wall at the left of the breaker. When work is to be done on the breaker the boards are put in and the doors of the cubicle are locked. The barriers in the disconnect cubicles on the floor below are normally in place to prevent the open



Protective Barriers Prevent Disconnect Blades from Dropping Into Bottom Clips

blades from dropping into the bottom clips which might make the oil circuit breaker alive by feed back from the line or introduce an unwanted dead ground potential level in the breaker compartment, the breaker frame being normally grounded through the fault bus. The breaker may thus be worked on without hazard. The disconnecting switch at the bus side of the breaker closes into the bottom dip at 90-deg. opening and must be in that position when the board is inserted.

Appliance Survey Shows Market Possibilities

WITH meter routes as guides, salesmen of the Northwestern Electric Company, Portland, Ore., made house-to-house calls on 1,424 residential customers to determine the number of appliances in use in each home. At the same time a study was made of consumption and revenue for 34 domestic customers having various numbers of appliances. Results of both investigations are given in the accompanying tables.

On the questionnaire used, 22 appliances were listed, ranging from electric clocks and radio sets to electric ranges and other heavy consumption appliances. In 1,424 homes the average number of appliances per home was found to be 7.7. Ten customers having eight appliances each, not including an electric range, showed a monthly consumption of 86 kw.-hr. and bill of $3.45, with annual consumption of 1,032 kw.-hr. and revenue of $41.40. It is interesting to note that the average domestic consumption for all residential customers on the lines of this company in 1928 was 1,038 kw.-hr., which is

Average Consumption and Revenue for Typical Groups of Domestic Customers in Portland, Ore.

	Average Kw.-Hr. Monthly	Average Monthly Bill	Average Kw.-Hr. Annually	Average Annual Bill
Thirteen customers having lights only or lights and iron	23	$1.46	276	$17.52
One customer reporting fifteen appliances (maximum reported)	1,137	24.33	13,644	291.96
Ten customers with eight popular appliances, not including range	86	3.45	1,032	41.40
Ten customers with nine popular appliances, including range	259	7.41	3,108	88.92

Appliance Saturation for 1,424 Domestic Customers in Portland, Ore.

Appliance	Per Cent Saturation	Appliance	Per Cent Saturation
Electric irons	103	Water heaters	7.5
Vacuum cleaners	72	Electric ironers	6
Toasters	63	Warming pads	4.5
Curling irons	50	Fans	2.5
Washing machines	45	Clothes driers	1.0 or less
Waffle irons	42	Electric mixers	
Percolators	42	Dishwashers	
Electric ranges	37	Electric cookers	
Radio receiving sets	32	Egg cookers	
Portable air heaters	17	Electric clocks	
Electric refrigerators	9		
Average saturation for 22 appliances included in survey			36

almost identical with that of the ten customers having eight appliances each.

The table showing appliance saturation indicates clearly which appliances of high load building value sales effort should be concentrated upon. Also the table showing consumption indicates that when a customer is raised from the class of one having lights only or lights and iron to the class of one having eight, or the average number of appliances, the power company derives $1.99 additional revenue monthly, and if the same customer is raised to nine appliances, including an electric range, the additional monthly revenue is $5.95. One of the surprising things shown by the survey was the unexpectedly low radio saturation of 32 per cent.

Brick Making Less Costly When Electricity Is Used

ONE of the first brickyards along the Hudson River to electrify any considerable portion of its production processes was that of the Jova Brick Works at Roseton, N. Y. Modernization has been extended gradually as each such successive step justified itself, until today electrical energy is used for almost all applications to which it may be economically applied. A recent survey of production figures with accompanying readings of strategically located watt-hour meters offered some interesting data, a recapitulation of which is shown in the accompanying table.

At this plant electrically operated shovels dig the clay from the banks, motor-driven machines mix the materials, machine-molded bricks are turned out at high speed and specially designed equipment moves large quantities of finished brick from kiln to barge for shipping. The plant has a total capacity of 214,000 bricks daily from both steam- and electric-driven units. In one operation the handling costs per thousand have been reduced, according to J. L. Jova, from somewhat more than $1 to approximately $0.25 by virtue of the motor-driven mechanical equipment employed.

A Timely Message to Avoid Service Interruptions

KITE SEASON
MANY interruptions to electric service in Spring can be eliminated if parents will caution their children not to fly kites near lines carrying electric power,
Wires used to strengthen the kite, wet string or tail and tinsel used for a tail, if caught across two such lines are sufficient to cause a short circuit, thus depriving many of electric service.
An element of danger to the boy himself exists when he climbs poles to extricate his kite from such lines, in that he may come into contact with wires and be severely burned or knocked to the ground.
Radio aerials should never be attached to poles or at any other place where they might touch power lines.
If parents will impress upon their children, especially the boys, the dangers of such practices, they can save themselves much anxiety and worry and prevent interruption of electric service to their homes.
DUQUESNE LIGHT COMPANY
Live in and Expand Your Business in Greater Pittsburgh

THE above advertisement was published recently by the Duquesne Light Company in an attempt to reduce the number of service interruptions and accidents caused by the spring activities of youth. The message reads as follows:

Many interruptions to electric service in spring can be eliminated if parents will caution their children not to fly kites near lines carying electric power.

Wires used to strengthen the kite, wet string or tail and tinsel used for a tail, if caught across two such lines, are sufficient to cause a short circuit, thus depriving many of electric service.

An element of danger to the boy himself exists when he climbs poles to extricate his kite from such lines, in that he may come into contact with wires and be severely burned or knocked to the ground.

Radio aërials should never be attached to poles or at any other place where they might tough power lines.

If parents will impress upon their children, especially the boys, the dangers of such practices, they can save themselves much anxiety and worry and prevent interruption of electric service to their homes.

Energy Consumption at a Modern Brickworks

(Period of October 17—December 11, 1928)

Amount of brick made by electric drive, thousand	4,887
Total kilowatt-hours used for digging, burning and handling	85,000
Kilowatt-hours used for making 4,887 thousand	23,100
Kilowatt-hours used to dig, burn and handle 2 x 4,887 thousand bricks, since 4,887 thousand bricks were made during this period by steam drive	61,900
Kilowatt-hours used to dig, burn and handle 4,887 thousand bricks $\frac{61,900}{2}$	30,950
Kilowatt-hours required to dig, burn, make and handle 4,887 thousand	54,050
Kilowatt-hours per thousand for digging, handling and burning $\frac{30,950}{4,887}$	6.25
Kilowatt-hours per thousand for making $\frac{23,100}{4,887}$	4.75
Kilowatt-hours per thousand to make, burn, dig and handle $\frac{30,950+23,100}{4,887}$	11

NOTE:

All the clay is dug by an electric shovel.
The clay itself is handled by gas cars.
Two 110,000 Lancaster auto-brick machines.
(1) One driven by a steam engine.
(2) One is driven by 165 hp. in motors.
Transfer cars are electric, alternating-current.
High-pressure burning. Two 75-hp. compressors.
Handling and loading by Penfield method. 75-hp. motor-generator set.

DEMANDS:

Burning, shoveling and handling equipment, kw	200
Burning, shoveling and handling one brick machine, kw	306
165 hp. in motors on brick machine, kw	140

Commissioner Prendergast

Takes Issue with Governor

on Investment Basis for Valuation

STATING that the public utility commission law of New York State is indisputably in need of amendment, Chairman Prendergast of the New York commission took sharp issue with the view of valuation expressed by Governor Roosevelt in approving the act of the Legislature appointing a temporary commission to make a study of that law. The occasion was the annual meeting of the accounting section of the Empire State Gas and Electric Association.

The point of Mr. Prendergast's disagreement was the passage in Governor Roosevelt's memorandum stating that "the theory of twenty years ago that the return to public service corporations should not exceed fair profits on the money actually invested is constantly and flagrantly violated."

W. A. Prendergast

In reference to this statement Chairman Prendergast said in part:

"My purpose is to show that what Governor Roosevelt speaks of as a 'theory' has not been and is not now the law of this state nor a principle of valuation recognized by our own highest courts or the courts of the nation.

" 'Money actually invested,' stated by Governor Roosevelt, has never been a theory underlying or existent in the public service commission law of New York State."

Mr. Prendergast reviewed public utility regulation in New York State from the first general railroad law in 1850, which provided for a 10 per cent return on "capital actually expended." "It would appear," he said, "that this provision was inserted for the purpose of protecting the company against any reduction in profits beyond 10 per cent, which was fixed as the minimum and was designed to satisfy prospective investors in the railroad development which was to follow. The term 'capital actually expended' could not have been used in 1850 in contradistinction to the modern 'fair value' rule, which was not foreshadowed until over forty years later.

"The term 'capital actually expended,' while used in the 1910 revision of the law as to common carriers and gas and electric corporations, was only specified as one of the factors to be considered in fixing rates."

Continuing, Mr. Prendergast referred to a decision of the Appellate Division, Third Department, in 1921, where the court stated that the commission "is not bound by the capital actually expended in 1912." He pointed out that in 1922 the same court restated its position in determining the rates of a gas corporation under the laws of the state as follows:

"We must seek to ascertain the fair value of the property which it is using for the convenience of the public."

In this case, the court held that the company was entitled to have appreciation in value of property acquired through capital actually expended included in estimating the value of the property.

The last decision of the state courts on the question of valuation of gas and electric property was in 1925, Mr. Prendergast stated, when the Appellate Division said:

"It is now too well established to admit of discussion that a public utility is entitled to a reasonable return on the value of its property used in the public service at the time of the inquiry."

Quoting from several decisions, Chairman Prendergast said:

"We have presented a considerable body of opinion determining a basis of valuation, all of this prior to the passage of the public service commission law of this state in 1907. This law was adopted by the State of New York with full knowledge of the prevailing judgment of the courts of the country on this subject of valuation, and there is no provision of the New York statute which runs contrary to the prevailing judgment."

Practice in Massachusetts

Referring to Massachusetts practice, Chairman Prendergast said:

"It has been asserted that the Massachusetts doctrine of 'prudent investment' is the ideal that should be followed in the valuation of the properties of public utilities. But to what extent is this ideal followed? Let a member of the Department of Public Utilities of Massachusetts speak on this subject. I quote what he (Henry G. Wells) said in answer to some observations I made on this subject at the convention of the National Association of Railroad and Utilities Commissioners at Dallas, Tex., October 18, 1927:

> Just one other statement. In the comment on prudent investment it (Prendergast address) says: "Merely analyzing their own statements as bearing upon their own Massachusetts theory of prudent investment." Whatever may be the opinion of different individuals as to whether prudent investment is a proper rate basis or not, since the consolidation of the departments in Massachusetts in 1919 the commission has not considered prudent investment as the Massachusetts theory. I am not at all surprised that the general public throughout the country has felt that that was the Massachusetts theory, that the Massachusetts theory on which rates were based was prudent investment. It grew up out of a decision before the consolidation a great many years ago in a street railway case where there had been a depreciation in the value of the property. The representatives of the public attempted to set up as a rate basis upon which the rates on that street railway should be figured the reproduction cost theory, which was manifestly less than was indicated as prudent investment.
>
> The commission fixed the rates—the old Public Service Com-

mission fixed the rates on prudent investment because they felt that the stockholders had honestly and prudently invested their money in the property, and the fact that the value of that property was less than that prudent investment was of no moment. That is the origin of the so-called "Massachusetts rule" of prudent investment, and as you can see it arises from an entirely different conception than is usually held. In other words, the doctrine of prudent investment as the Massachusetts theory is quoted as opposed to reproduction cost theory where the reproduction cost is more than the prudent investment; whereas the only decision in Massachusetts was based on the fact that the prudent investment was more than the reproduction cost.

Farm Electrification from Management Viewpoint

By R. F. Bucknam
Department of Farm Management, New York State College of Agriculture

BUILDING load on existing lines and estimating the prospective load on proposed extensions are two important problems of rural electrification. With the few customers per mile, usually obtainable in rural districts the consumption per customer must be high to warrant the building of lines. To make large use of electricity on farms economically profitable it must be used to free labor for other work or to eliminate paid labor. It must be used to operate milking machines, grind feed, cool milk or other jobs of economic importance for which it is adapted.

Immediate solution of many farm problems is hampered by agricultural traditions. While it may be expedient, pending standardization, to adapt farm equipment to electric operation merely by changing the drive, farm jobs need to be analyzed so equipment can be designed which will give the most effective results with electric drive. Another field for the inventive genius is the building of an efficient lightweight battery system which can be used for tractive power on the farm.

We should know something of the prosperity, both present and prospective, of the customer to be served. There certainly is no use of building a line into a community which is submarginal and is being abandoned. There will be no economic advantage in encouraging farmers to stay on land that will not give them a living.

Table I—Effect of Various Factors on Rural Consumption

Based on Records of 335 N. Y. Farms

Factor	Avg. of Item	Correlation with Annual Consumption, Ignoring All Other Variables	Per Cent of Net Variation in Annual Use Due to Each Cause
Total acres	120.9	+0.49	4.3
Crop acres	64.4	+0.32	— 1.7
Number of cows	14.5	+0.49	13.9
Number of hens	180.0	+0.22	.6
Number of motors under 1 hp.	0.556	+0.32	1.9
Number of motors over 1 hp.	0.267	+0.47	5.3
Total horsepower of small motors	0.201	+0.33	4.2
Total horsepower of large motors	0.51	+0.42	1.0
Size of milker motor	¼-1	+0.42	1.0
Water system	.....	+0.24	1.0
Months poultry lighting	1.32	+0.07	—0.1
Years used	4.6	+0.16	0.2
Household appliances (watts)	1052	+0.24	1.0
Connected light (watts)	1452	+0.59	20.1
Cost of wiring	$235.00	+0.37	1.3
Amount paid per kilowatt-hour, cents	11.6	—0.32	3.6
Total			68.1

Table II—Per Cent Variation in Annual Consumption Due to Various Factors

Casual Factor	Type of Farming: Small Farm, Per Cent	Crop Farm, Per Cent	Dairy and Crop, Per Cent	Dairy, Per Cent	Poultry, Per Cent
A Connected light (watts)	58.3	43.7	18.1	24.4	22.1
B Acres of crops	....	11.1	4.2	....	....
C Number of cows	....	....	13.9	25.6	....
D Number of hens	....	....	....	....	24.2
E Total horsepower of motors over 1 hp	....	24.5	....	....	....
F Milker motor*	....	....	30.1	7.6	....
G Water system†	....	....	....	5.0	....
H Cost per kilowatt-hour	....	....	....	....	8.6
I Household appliances (watts)	23.2	....	....	....	....
Total per cent of variation accounted for	81.5	79.3	66.3	62.6	54.9

*Code for milker motors. †Code for water system.

Code—Horsepower	Code—System
1—¼-½-¾	1—None
2—½	2—Neither house nor barn, but other buildings
3—¾	3—House only
4—1	4—Barn only
5—1½	5—House and barn
6—1½	6—House, barn and other buildings
7—2	
8—2½	
9—3	

I think that utilities could play a part in putting these men back on their feet, not in a spirit of altruism or charity, but simply as a method of selling more electricity.

There seems to be a general tendency in the state to get away from customer contributions for line constructions. Some of the Midwestern companies have even gone so far as to underwrite the wiring and equipment charges simply as a means of building load and seem willing to demonstrate that farm electrification is of economic advantage to the farmer.

Besides developing economical line construction, studying rural-line characteristics and obtaining data on the relation between connected load and actual demand more attention should be given to the upper limits of load which utilities are willing to accept. Is farm use of electricity going to be confined to motors of 3 hp. or less, 5 hp. or less, or 10 hp. or less? Under what conditions may it be possible to get three-phase current? Is there a possibility of serving threshing and silo-filling loads as in Europe?

There is a great deal of merit in a split or an inducement type of rate because of its theoretical justification and psychological effect. With a rate composed of two or more parts the energy rate is the only thing many people talk about.

While a minimum rate based on the number of customers per mile may be defended on the basis that it equitably distributes the cost incurred, it seems that a scheme which would give an average cost for average usage, a penalty for smaller consumption and a reward for generous use might have more merit. In order not to have too much mileage of low-load line, Canadians require that there be a demand of at least 15 kw. for each mile.

When the effect of rates on the amount of energy used is considered, a slight change in the rate does not make a great deal of difference. The amount paid for electricity becomes a deterrent only when the rates exceed about 13 cents per kilowatt-hour, according to observations.

We can find what appliances farmers are using, how long they have used them and what effect the use of any particular appliance has on the annual load for the line.

If we do this the contact man for the companies can render a service as well as make sales.

There is a rather uniform increase in the consumption per customer according to the experience of one Middle West company. For example, 100 customers had 34 per cent greater consumption at the end of the five years than at the beginning, when their average was 64 kw.-hr. per month. On the other hand, records of New York State farmers show little increase during the first three years and then a rapid increase. The financial condition of the customer at the time of the original installation may have an important influence, but we need more information.

Sixteen independent variables which cause variation in the annual consumption of electricity have been observed on New York farms and are indicated in Table I. For example, variation in total acres of the farm is responsible for 4.3 per cent of the variations in consumption. The outstanding factor seems to be the wattage of connected light and the number of cows.

Studying these records, it became evident that there was not enough similarity among them. For instance, studying the poultry records alone showed there was an important increase in use according to the number of hens. When these were thrown into the large group the importance of the other factors almost obliterated the effect of additional number of hens. To get around this difficulty the farms were sorted according to type. The percentage variation in annual kilowatt-hours consumed due to various factors is shown in Table II.

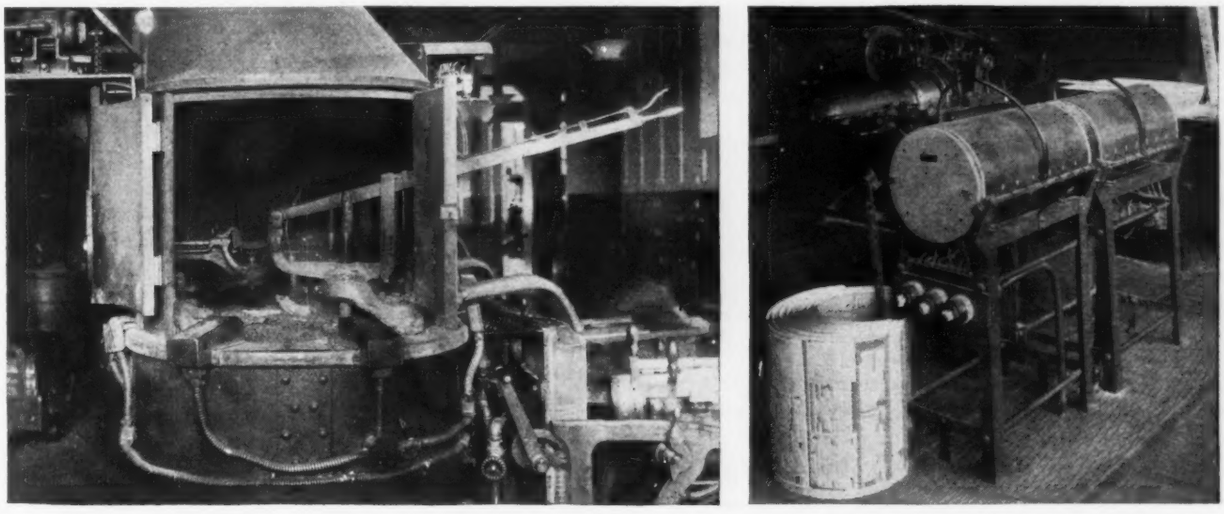
On the small farm, which is little more than a suburban residence, the variations in the wattage of connected light and the wattage of household appliances account for 81½ per cent of the variation in the use of electricity. On the crop farms the most important factors seem to be the wattage of connected light, acres of crops and the total horsepower of motors with a capacity of 1 hp. or over. On the dairy farm the number of cows and the connected light are most important, while some influence is exerted by the size of the motor on the milking machine and the extent to which the water system is electrically operated. The amount paid per kilowatt-hour seems to be effective only in the case of poultry farms. The poultry man has the most extensive job of wiring and the heaviest lighting load, but since his load is entirely a lighting load most of the rates do not give him the consideration to which he is entitled as compared with other farmers who may consume part of their electricity either as power or heat.

It seems to me that the biggest need for developing the farm problem from the economic point of view is a real study of the information we already have at hand.

Electric Type-Melting Pots Offer Many Advantages

By E. E. Schofield
Industrial Engineer Washington Water Power Company, Spokane, Wash.

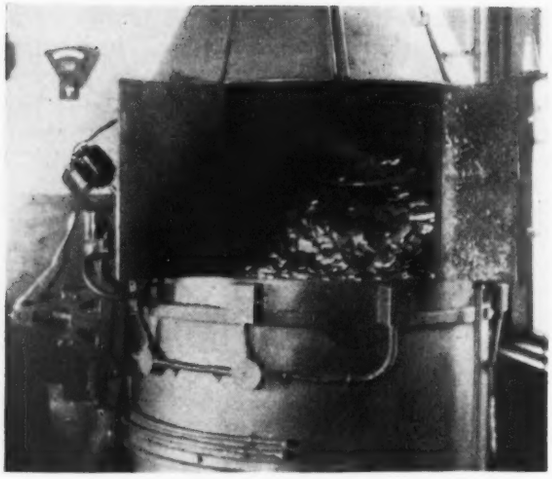
A YEAR'S experience with electric stereotype and linotype melting pots in the composing room of the Cowles Publishing Company, Spokane, Wash., publisher of the *Spokesman Review*, the *Chronicle* and the *Washington, Oregon and Idaho Farmer*, has demonstrated some decided advantages of electric heat as compared with fuels. These advantages include reduction in labor and attendance due to close temperature control of the stereotype metal at all times, maximum rate of heating the metal without danger of overheating, reduction in number of rejects due to uniform quality, reduction in maintenance because of even distribution of heat over the equipment heated and elimination of flames in direct contact with the pot, reduction in metal losses, greatly improved working conditions and reduction of fire hazard. The equipment is popular with the workmen and as a result production has increased.



Five-Ton, 60-Kw. Stereotype Pot Which Has Increased Production and Reduced Labor in Newspaper Plant and Electrically Heated Roasters for Newspaper Mats

The installation consists of three Hoe melting pots, including a 5-ton, 60-kw. stereotype pot, a 5-ton, 45-kw. linotype pig melting pot and a 2,500-lb., 15-kw. flat stereotype melting pot, as well as two electrically heated mat roasters rated at 19 amp., 220 volts.

Records kept since the installation of the 60-kw. pot show an average monthly production of 500,000 lb. of plates per month with an average monthly consumption



Linotype Pig Melting Pot of 5-Ton Capacity Requiring 45 Kw.

of 14,000 kw.-hr., or an average of 28 kw.-hr. per 1,000 lb. of metal melted. In a single test run over a four-day period an average consumption of 21.8 kw.-hr. per 1,000 lb. of metal melted was obtained. Twelve 5-kw. General Electric helicoil cast-in immersion units are mounted around the rim and extend to a depth of 18½ in. into the 60-kw. pot. Besides the automatic temperature control apparatus there is a temperature limit fuse to prevent the molten metal from exceeding 800 deg. F. The three-phase service supply allows the use of a Y-delta switch in the heater circuit, permitting a reduction in energy input to one-third normal when no casting is being done. It has been found more economical to use this connection and keep the metal at a temperature of 550 deg. F. during the long periods of the day when no casting is being done rather than to let the metal solidify and remelt it.

Records for the 5-ton, 45-kw. linotype pig melting pot have not been kept, but it is estimated that approximately 125,000 lb. of metal is melted per month with an average monthly consumption of 4,800 kw.-hr. This unit is provided with nine 5-kw. helicoil units installed in the same manner as in the stereotype pot.

It is estimated that 50,000 lb. of metal per month is melted in the 2,500-lb., 15-kw. flat stereotype melting pot and that the average monthly consumption is 3,000 kw.-hr. Three 5-kw. immersion heating units of the type used in the other pots are employed.

The electric mat roasters were built on special order in Spokane and replaced gas-heated units formerly used.

SAM A. BAKER

Ex-Governor of Missouri, Says:

"THE people you serve are the judges of your efforts, and in my opinion the efforts of your industry are coming more and more to be appreciated, and just as long as you keep in mind the fact that he profits most who serves best you will continue to have the co-operation of the public. . . .

I believe that there should be a course of study in our public schools on public utilities and their service and relation to the public.

As citizens, we know too little of conveniences we accept as matters of course. We do not think past the wall plug that gives us energy, heat and light."

Address before convention of the Middle West Division, N.E.L.A., Omaha.

Letters from Our Readers

Economical Size of Conductor

To the Editor of the ELECTRICAL WORLD:

Many articles have been published indicating a solution of the problem of determining the economical size of conductor. All of the solutions which I have seen have two serious drawbacks which have prevented popular adoption by engineers engaged in the design of distribution systems. These drawbacks are, first, difficulty in determining various quantities for substitution in the formulas used and in solving the equations presented; second, none of the methods I have examined contains an adequate solution for the economical size of conductor over a period of years during which the load is continuously growing.

It seems impossible to eliminate these disadvantages from any formula derived from Kelvin's law. However, after a long series of computations to determine the total aggregate annual costs of various conductor sizes applied to a typical system to serve a growing load over a period of years the following principle was evolved, which I believe may be applied simply and confidently to almost any distribution system for determining primary and secondary conductor sizes:

"The economical conductor size for any distribution system service is such that the conductor will be loaded to its capacity as limited by permissible voltage drop at the termination of its physical life, but not before."

This means that in designing a system the load conditions which will obtain at the end of the physical life of the conductor, say ten to fifteen years, should be used. Evidently, this will result in specifying conductors much larger than initial conditions require. In order to enjoy the maximum economies available, advantage should be taken of this initial excess size by reducing the initial number of primary circuits, deferring the installation of induction voltage regulators or deferring the installation of auxiliary substations feeding into the primary system. On the secondary side, the initial number of transformer installations may be decreased, with corresponding increase in the initial length of secondary run from the transformers; future load increase may be met by simply adding transformers and correspondingly cutting down the length of secondary runs.

The simplicity of application of this design principle is at once apparent, and it is to be regretted that the proof of its accuracy for general application (which would involve no less than a long series of checks for typical cases) would be too voluminous for publication. As a guide in a rather uncharted field, I have found it quite useful, and it is presented here for the consideration of those who may be interested in the subject.

G. D. HORNE,
Field Engineer.

Phoenix Utility Company,
Barranquilla, Colombia, Apartado 200.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Design of 11,000,000-Yd. Earth Dam for Saluda River Power Project.—ARTHUR R. WELLWOOD.—About eighteen months ago construction was started at Dreher Shoals, on the Saluda River 10 miles west of Columbia, S. C. The dam will impound water for the generation of electric power and will be the largest high earth dam in the world, 208 ft. high, 7,838 ft. long on the crest, 1,150 ft. maximum width, and will contain 11,000,000 cu.yd. of fill. The initial installation of 200,000 hp. of prime mover capacity in the power plant, consisting of four generating units, will deliver 300,000,000 kw.hr. of primary electrical power annually while operating under a maximum head of 183 ft. and under an average head of 165 ft. The ultimate capacity of the plant is 300,000 hp., which will be made possible by the addition at a later date of two generating units.—*Engineering News-Record*, April 25, 1929.

Units, Measurements and Instruments

The Testing of Porcelain Insulators.—B. L. GOODLET.—A discussion of the technique of porcelain insulator testing. The ground covered includes the usual electrical and mechanical tests called for in the various national specifications and also special tests of more recent origin. The testing of porcelain insulators is a subject the broad principles of which are familiar to every electrical engineer. Nevertheless, although many engineers have witnessed tests of this nature which may appear to be very simple and straightforward, it is only a very small proportion of the profession who have actually been responsible for the conduct of such tests. The result of this condition of affairs is two-fold. In the first place the tests at present in vogue are often carried out in a very unsatisfactory manner and the results subjected to all kinds of misinterpretations. In the second place, some of the tests called for, even in the national insulator specifications, do not reveal that intimate knowledge of conditions in the testing room and in service which is so desirable. The discussion is devoted to a write-up of the technique of the usual tests and those now becoming popular. The bearing of these tests on the actual service performance of the insulators is also considered.—*Report of the Institution of Electrical Engineers*, April 11, 1929.

Million-Volt Laboratory.—A. MATTHIAS.—A description of the first German 1,000,000-volt laboratory erected at the University of Berlin. Being greatly hampered by lack of space and funds, the equipment had to be housed in the yard between two buildings, with a simple wood structure roof above it. A minimum of expense was incurred by the choice of three air-insulated, 100-kva., 333-kv. chain-connected transformers. It is claimed that from the pedagogical standpoint the open construction of the air-insulated transformer type gives the student a better conception of the apparatus than the oil-immersed construction. Provision is made to connect the three identical units into a 575-kv., three-phase bank. A remote-control adjustable spark gap with a 1,200-mm. upper sphere and a similar lower, grounded half-sphere serves as a voltmeter. A Palm type crest voltmeter is also installed. A set of Tesla coils and a cathode-ray oscillograph are part of the equipment. —*Elektrotechnische Zeitschrift*, March 14, 1929.

Generation, Control, Switching and Protection

Extra-High-Tension Cable Protection by Petersen Arcing Ground Suppressors. — F. RÜDENBERG. — The greatly augmented demand for electricity by large towns renders it imperative to obtain the greater part of the energy from outside, either in view of the presence of cheap water power or because the lower cost of the building site and the better cooling water conditions enable steam power to be generated more cheaply. Even with relatively short transmission distances voltages of 50,000—in fact, even 132,000—are necessary to transmit the energy economically to the city network. For instance, it was possible in Berlin to erect successfully a 100,000-volt overhead line of several miles in the streets at the edge of the city. It will now most probably be necessary to lay cable for the same voltage in the center of the city. The layout of many other towns is such that transmission by cable must be adopted even in the suburbs. During the last few years quite a number of German towns have installed super-tension cables. It is obvious that from a financial viewpoint such cables represent a valuable asset. With due regard to this fact, as also to the realizing of an uninterrupted energy supply, it is expedient to protect the cable in the most effective way.—*A.E.G. Progress (Germany)*, April, 1929.

New Extra-High-Capacity Oil Circuit Breaker.—G. ERÉNYI.—In addition to the voltage and amperage, the size of the short-circuit load with which a circuit breaker has to deal has a decisive influence on the design of the breaker. The product of a certain manufacturer may incorporate many of the fundamental features of all types of his make, but there is a marked difference exhibited when it concerns the breaker's rupturing capacity, especially so at voltages below 35,000. The rupturing capacity of so-called oval-tank type breakers can be increased to about 300 megavolt-amperes from 150 by adding explosion chambers, but without any basic modifications. The sphere of application of the extra-high-capacity circuit breaker commences at short-circuit loads above 300 megavolt-amperes.—*A.E.G. Progress (Germany)*, April, 1929.

Transmission, Substations and Distribution

High-Voltage Bushings.—W. H. THOMPSON.—To bring a conductor at high potential through an earthed plate is a problem in electrostatics and one which to the present day has proved very difficult of satisfactory solution. By virtue of its capacity, it is not possible for a conductor to be at a high potential, or any potential, for that matter, without carrying a charge. A charge immediately infers lines of force, and lines of force are a conception of Faraday to explain the action of force across space. The bushings exist in a state of tension and lateral repulsion. The magnitude of the former is a variable quantity, which follows from the definition, since this tension varies directly as the density —*Electrician, (England)*, April 19, 1929.

Aluminum Alloy Cable.—A. FUCHS. —Pure aluminum cables are satisfactory on lines where snow and sleet are not to be expected. For greater strength steel-core aluminum cables are widely used. Such combination cables diminish, however, the advantages of low weight and cost, otherwise expected of aluminum lines. The reclaim value of old combination cables is less than that of either pure copper or pure aluminum. In Germany, where all copper has to be imported, but where limitless quantities of aluminum are available, efforts have been made to find an aluminum alloy suitable for transmission lines, but stronger than unalloyed aluminum. Five years of experience seem to indicate that what is called "Aldrey" aluminum alloy has satisfied all requirements. The specific weight of the alloy is 2.7, tensile strength is 33 kg. per sq.mm. and conductivity averages 31 m/sq.mm. ohms at 20 deg. C. Compared with copper, a saving of 30 per cent may be realized on the cable itself, and, in addition, lighter towers and hardware are required.—*Siemens Zeitschrift*, March, 1929.

Illumination

Illumination of Open Spaces.—CYRIL SYLVESTER.—The illumination of open spaces is an important section of the design of lighting installations for any industry. No section of industry is complete between four walls. The foundry must have space to store boxes. A

boiler shop must have space to store boiler plates. The engineering shop must have adequate space to store material, just as the sawmills must have sufficient space to store tree trunks and sawed logs. It is most essential that the lighting installation for the illumination of these spaces shall be quite as efficient in design as any interior. The illumination of open spaces has not received the attention it deserves. It is true that attempts have been made to illuminate them, but inadequate and old-fashioned methods have been adopted. It has not been realized that, in the majority of cases, equipment which is suitable for one purpose is not suitable when used for another. — *Electricity (England)*, April 4, 1929.

The Lighting of St. Martin's.— While the fame of most well-known churches depends on their antiquity, that of St. Martin's-in-the-Fields, London, is due mainly to its modernity. The present building is only 200 years old and is of the classic style favored in the early eighteenth century. The interior, from the illumination point of view, does not present so many difficulties as the usual style of church in which the nave is of great height. In St. Martin's there is a ceiling richly decorated with cerulean and gold panels, which permits of a very definite lighting scheme.—*Electrical Review*, April 19, 1929.

Motors and Control

Electro-Mechanical Vibrator. — W. SPÄTH.—Certain parts of mechanical and electrical machinery are continuously subjected to translatory or torsional vibrations while they are under a more or less pronounced tensile stress. The problem of "fatigue" enters into these parts more than into any other. It is difficult to design such parts sufficiently strong to withstand combination stresses of this nature on account of meager test data. The writer developed a vibrator by means of which accelerated life tests can be made on samples, while they are subjected to any desired tensile stress. The vibrator is essentially a single-phase induction motor with a squirrel cage armature, the stator of which is specialy wound to exert upon the armature a powerful torsional vibration of supply frequency. A mechanical energy of up to 800 watts can be delivered to the test sample.—*Elektrotechnische Zeitschrift*, March 28, 1929.

Heat Applications and Material Handling

Electrically Heated Rotary Carburizer. — H. M. CHATTO. — An electric rotary carburizing furnace recently installed by the Claremont, N. H., plant of the Sullivan Machinery Company is pictured. The installation consists of a rotary alloy cylinder inside an electrically heated, automatically controlled box-shaped furnace chamber. The heating units comprise three windings of the ribbon type operating on 220-volt, three-phase circuit and having a connected load of 72 kw. A standard automatic control panel is used in conjunction with a Leeds & Northrup two-point recorder controller. One thermocouple is placed in the furnace chamber with the sensitive end near the winding and the other is placed inside the revolving crucible. An ingenious collector ring and brush mechanism makes electric connection between the thermocouple and the control panel. The furnace is mounted on trunnions, which allow it to tilt sufficiently to dump the charge by gravity. A handwheel, coupled to the furnace shell by a train of gears, provides easy tilting. — *Iron Age*, April 25, 1929.

Traction

Economical Operation of the 3,000-Volt, Direct-Current Electrification of the Paulista Railway.—GUY BELLOWS. —The latest operating statistics, made available through the courtesy of the railway company, are furnished. With the close of the year 1928 the Cia. Paulista de Estradas de Ferro completed the electrification of its broad-gage main line between Jundiahy and Rincao, Brazil, totalling 286 km. (178 miles). The electrification of this railway, which was begun in 1920, by the initial step of 44 km. (27 miles) of double track, has progressed in three extensions in stages of 50, 40 and 152 km. (31, 25 and 94 miles, respectively). Serving this electrified zone are eight substations having a combined total normal capacity of 22,500 kw. with a five-minute rating of 67,500 kw. Electric power is shown to be far more economical than the use of fuel for operation.—*General Electric Review*, April, 1929.

Electrophysics, Electrochemistry and Batteries

Apparatus for Thermomagnetic Analysis. — RAYMOND L. SANFORD. — Thermomagnetic analysis consists of the study of magnetic effects occurring in a material during heating or cooling, with special reference to their interpretation in terms of structural changes or transformation. It is most conveniently carried out by means of a magnetometer of suitable type. The present paper describes thermomagnetic analysis apparatus set up at the Bureau of Standards and gives typical results obtained by its use.—*Research Papers No. 50, Department of Commerce*, April, 1929.

The Electrical Equipment of X-Ray Apparatus.—L. G. H. SARSFIELD.—The paper opens with a brief review of the equipment necessary for modern X-ray work. The details mentioned in the opening paragraphs form the subjects of the sections into which the paper is divided. These subjects include induction coils, X-ray transformers, filament-heating transformers, rectification, d. c. equipment, tests and electrical measurements, switchgears, and controls, fittings and special sets. In the induction-coil section reference is made to two new models which have some special features. In the fairly detailed discussion of X-ray transformers an attempt is made to indicate the service required from an X-ray unit and some practical features of design calculated to provide this service. Some particulars of secondary coils and bushings are included. —*Journal of the Institution of Electrical Engineers (England)*, April, 1929.

Miscellaneous

Wire Transmission of Photographs. —P. ARENDT.—Practical details are given on the now widely and regularly used European picture transmission method system Telefunken-Karolus-Siemens. The usual size of negative transmitted is 7 x 10 in., with a screen of from 75 to 130 lines per inch width. When sending through overhead lines a fundamental frequency of 6,500 cycles is used, requiring slightly more than three minutes for one picture. Cable transmission calls for not over 1,125 cycles, requiring nineteen minutes, while as high as 18,000 cycles may be used for radio transmission, cutting the time down to 1.2 minutes, considering in each case a screen of 150 lines per inch. Equipments installed in several English and Japanese newspaper offices are described in detail and some samples of transmitted pictures are given.—*Siemens Zeitschrift*, March, 1929.

Electric Accidents in Switzerland (Official Report). — Biannually the Swiss Federal Electrical Society makes a detailed statistical report of all electrical accidents which occurred during this time. The report classifies the accidents in various ways, such as voltage involved, type of occupation of the victims and type of serve on which it occurred. Every accident is completely described. A study of these records is rather interesting and should prove of considerable value to students of safety measures. It is, for example, noteworthy that voltages of 500 and less caused far more accidents than voltages of 10,000 or more. Faulty portable lamps killed four people.—*Bulletin de l'Association Suisse des Electriciens*, April 7, 1929.

Four Thousand Employees and an Error Ratio of Only 0.008 of 1 per Cent. —W. W. DARLING.—Since we are serving over 800,000 customers, representing about 880,000 active accounts, it will be seen that the 4,000 employees of our company have plenty of opportunity for making errors. For example, we figure that each of our 850,000 meters offers at least ten opportunities per month for error, during the following operations: Reading meter, computing consumption, bookkeeping entry, computing charge, writing bill, addressing it, delivering it, collecting payment, final bookkeeping entry. This total of operations as compared with our average of monthly errors affecting the public shows that our present monthly average error ratio is only about eight one-thousandths of 1 per cent, and this relatively low percentage is one of the encouragements of our present error system.—*System*, May, 1929.

News of the Industry

Wyer Explains Smithsonian Pamphlet

His Study of Ontario Hydro-Electric System Paid for by Duquesne Light Interests—International Paper & Power's Investments in Newspaper Stocks

SAMUEL S. WYER, a consulting engineer of Columbus, Ohio, appeared before the Federal Trade Commission last Saturday to testify in the inquiry which the commission is making into the public utilities and their methods of propaganda. Mr. Wyer, it will be remembered, was the author of a study on the Hydro-Electric Power Commission of Ontario which was published in 1925, under the auspices of the Smithsonian Institution. He told the commission of this and other power investigations which he had made.

Following a letter written by Governor Pinchot of Pennsylvania to Governor Smith of New York in 1923, asking that the New York power system include plans "for delivering at the Pennsylvania line a due proportion of Niagara power to meet the needs of western Pennsylvania," Mr. Wyer made an economic study of the situation. For a time, he said, he worked with a committee of the N.E.L.A., but later broke with the committee and finished the report in co-operation with A. W. Thompson, the president of the Philadelphia Company, whose large steam-electric power holdings in western Pennsylvania, including the Duquesne Light Company of Pittsburgh, might be affected by transmission from Niagara. In Mr. Wyer's opinion, the N.E.L.A. committee wanted "a snappy report against government ownership, which I refused to render." He said he wanted to make a straight, fact-finding survey and considered the investigation for Mr. Thompson as most important.

In his study Mr. Wyer abstracted a long report of the Hydro-Electric Power Commission of Ontario previously unpublished. The cost of the survey, including publication, was $15,890. That the report was published under the auspices of the Smithsonian Institution, for which Mr. Wyer had been acting as consultant, though paid for by power interests, led to attack. Mr. Wyer pointed out to the commission that many Smithsonian activities are financed by private funds. He said that his findings were under fire by the more radical elements of the press, but that, although "bitterly contested, they were never refuted." As a result of the investigations he advised the western Pennsylvania power interests to go ahead with their developments independently of Niagara.

Other reports, including a study of Muscle Shoals and one of the St. Lawrence waterways project, were prepared by Mr. Wyer. The N.E.L.A. bought large numbers of some of these publications, he testified. The Muscle Shoals study was originally to be made by him without charge and sponsored by the Smithsonian Institution, but this plan was abandoned owing to premature publicity and unfavorable comment.

International Paper's Transactions

The day before Mr. Wyer was called to the stand William Lavarre and Harold Hall, whose recent purchase of three Southern newspapers was financed by the International Paper & Power Company, testified that the initiative in the negotiations came from them and not from the paper company, which simply acted as financier in the matter. The company retains notes to be liquidated by Hall and Lavarre, but does not hold control over the individual papers, they said. Power interests of the International Paper & Power Company had absolutely no part in the newspaper transactions, the witnesses asserted. Mr. Lavarre said that he only recently discovered that the company has any power holdings at all.

More testimony concerning the International Paper & Power Company's newspaper connections was heard on Wednesday. Utility interests are in no way concerned in the recent newspaper financing of the International Paper Company, according to testimony presented by the two publishers most prominent in the transactions. Frank E. Gannett of Rochester, N. Y., who, as reported last week, has bought out the International Paper stock holdings in his newspapers, and Samuel E. Thomason of Chicago both declared that the company's power holdings have no bearing on the case and that no utility firm proper owns or has owned securities in their papers.

Mr. Thomason of the Bryan-Thomason Newspapers, Inc., owner and publisher of the Chicago *Journal*, the Tampa (Fla.) *Tribune* and the Greensboro (N. C.) *Record*, pointed out that the loans advanced by the paper company came short of a controlling interest in his properties. The International, he said, owns about one-third interest in the Bryan-Thomason company. Last summer Mr. Thomason investigated several newspapers in various states, some of them very important perodicals, with the idea of buying one or more of them by financial aid of the International, he said, but no sale was consummated. That the Bryan-Thomason news policy is free from power-company influence was demonstrated by excerpts from the Chicago *Journal* attacking utility interests in Chicago and supporting the Federal Trade Commission investigation. Mr. Thomason admitted that he had made a blunder in omitting from postal records all mention of the International company.

Further testimony concerning the International company has to be heard on Thursday from Boston and Mobile (Ala.) newspaper publishers and others.

N.E.L.A. Appoints Committee on "Golden Jubilee"

A special committee on the "Light's Golden Jubilee" celebration has been appointed by the National Electric Light Association. It is composed as follows, the word "Company" being omitted:

T. O. Kennedy, Ohio Public Service, Cleveland (chairman).
S. G. Hibben, Westinghouse Lamp, Bloomfield, N. J.
N. H. Boynton, Nela Park, Cleveland.
Ward Harrison, Nela Park, Cleveland.
M. Luckiesh, Nela Park, Cleveland.
F. C. Eteson, Virginia Electric & Power, Richmond.
C. J. Eaton, Middle West Utilities, Chicago.
W. T. Blackwell, Public Service Electric & Gas, Newark, N. J.
J. Daniels, Edison Electric Illuminating, Boston.
R. J. Malcomson, Public Service of Northern Illinois, Chicago.
P. R. Labelle, Shawinigan Water & Power, Montreal.
H. L. Johnston, Duquesne Light, Pittsburgh.
H. S. Nonneman, Dayton Power & Light, Dayton, Ohio.
J. M. Shute, Allied Power & Light, Peoria, Ill.
W. J. Krug, Nebraska Power, Omaha.
R. B. Brown, Jr., Edison Electric Illuminating, Boston.
John Hogan, Northern States Power, Minneapolis.
Fred Zuagg, Northwestern Electric, Portland, Ore.
W. E. Carlson, Edison Lamp Works, San Francisco.
H. T. Rankin, Public Service of Colorado, Denver.
B. H. Martin, Tennessee Electric Power, Chattanooga.
R. F. Judd, Mississippi Power & Light, Jackson, Miss.
C. A. Norton, Westinghouse Lamp, New York.
E. E. Potter, Edison Lamp Works, Harrison, N. J.
H. M. Sawyer, American Gas & Electric, New York.
J. G. Learned, Public Service of Northern Illinois, Chicago.
H. M. McConnell, Electric Bond & Share, New York.
P. M. Callahan, Utilities Power & Light, New York.
F. J. Hodge, Byllesby, Chicago.
P. S. Young, Public Service of New Jersey, Newark.
G. E. Miller, Cleveland Electric Illuminating, Cleveland.
V. M. Fast, Associated Gas & Electric, New York.
C. C. Munroe, Detroit Edison, Detroit.
E. W. Lloyd, Commonwealth Edison, Chicago.
T. F. Kennedy, Henry L. Doherty, New York.
M. C. Huse, Philadelphia Electric, Philadelphia.
E. L. Hinchliff, Middle West Utilities, Chicago.
H. F. Barnes, Edison Lamp Works, Harrison, N. J.

In the Legislative Mills

Florida's Proposed Commission—Massachusetts Committee Votes Unanimously for Commission to Investigate "Power Trust"

LEGISLATURES in Massachusetts, Illinois, Wisconsin and a very few other commonwealths are still in session, but a large majority of the state lawmaking bodies have adjourned, leaving unenacted almost all of the important bills affecting utility companies that were introduced. Massachusetts seems likely to indulge in the investigation recommended by her joint committee on rules.

FLORIDA.—A bill introduced by Representative Smith proposing a tax of 2 cents per gallon on fuel oil is being fought hard by various utilities. The city of Jacksonville, whose electric light plant uses millions of gallons of oil a year, is leading the fight.

A bill has been introduced providing for a state utilities commission composed of four members. It is proposed that the commission shall have jurisdiction over all power and light companies, fix rates, etc., and that the present Railroad Commission be consolidated with it. Municipal utilities would be exempt from payment of the excise tax under the provisions of the bill.

ILLINOIS. — The seven Chicago traction bills, together with a subway bill, were passed by the lower branch of the Illinois General Assembly Tuesday, May 14, and are now ready to be considered by the Senate. These bills, the result largely of conferences between the traction interests of Chicago, a committee of the City Council and a citizens' traction settlement committee, are intended to adjust the Chicago traction situation. One of them amends the Commerce Commission act to provide home rule for that city.

MASSACHUSETTS. — The joint committee on rules voted unanimously on May 9 to report a resolve creating a special, unpaid commission consisting of one senator, three members of the House of Representatives and three men appointed by Governor Allen to make a thoroughgoing investigation into the activities of the so-called "power trust" in Massachusetts, including the National Electric Light Association and the New England Bureau of Public Service Information. The resolve will include suggestions in the resolves already filed by Representatives Hagan and Sawyer.

The proposed law to relax the restrictions under which municipalities may enter the electric light and power field in competition with regulated private companies may strike a snag in the Senate despite the more favorable attitude of the House. At this week's hearings Chairman Attwill of the Department of Public Utilities advocated the bill as a curb upon the activities of holding companies and local properties when inclined to retard rate reductions. Sheldon E. Wardwell, for the Massachusetts Electric and Gas Association, declared that it threatens "financial sabotage" and "does not contain a single word that in any manner curbs or controls the 'power trust.' "

MICHIGAN. — The Governor has signed the amended Rushton bill, which requires gas and electric utilities to obtain a certificate of convenience and necessity in certain cases but excludes municipal corporations from the provisions of the act. The Senate passed a bill providing for the incorporation by any two or more cities, villages or townships, or any combination or parts of these, of a metropolitan district or districts comprising territory within their limits for the purpose of acquiring, owning and operating, either within or without their limits, among others things, public utilities for supplying light, power or transportation. The Legislature adjourned May 15.

WISCONSIN. — Vigorous debate characterized the judiciary committee hearings last week on the public utility bills now before the Legislature. Representatives of the light and power companies denounced the district power and the state and municipal ownership bills drafted along the lines of the report of the interim committee on water power and electric utilities. (See ELECTRICAL WORLD for May 11, page 944.) W. A. Jackson, vice-president Milwaukee Electric Railway & Light Company, said the district power bill would take away home rule from every community. William Ryan, representing the Wisconsin Power & Light Company, said that the officials of the League of Municipalities were not authorized to speak for the communities they claimed to represent. Don Mowry of Madison pleaded for deliberation, praising the utility companies as upbuilders of the state.

A motion in the Assembly to reconsider the Reis bill to tax utilities at the local instead of the state rate was beaten by an increased majority—54 to 33.

Westinghouse Lighting Institute to Open May 30

Formal opening of the Westinghouse Lighting Institute in New York City has been set for the evening of Thursday, May 30, when about three hundred public utility executives from all parts of the country, on their way to the N.E.L.A. convention at Atlantic City, have been invited to visit it. Preceding the opening they will be the guests at a dinner given by A. W. Robertson, chairman of the board; E. M. Herr, president, and Walter Cary, vice-president of the Lamp company. The institute will be opened to the public on June 1.

As already explained in the ELECTRICAL WORLD, the Westinghouse Lighting Institute, occuping the entire seventh floor of the Grand Central Palace, is a contribution to the industry in the further development of the art of illumination. It will be a permanent laboratory for the use of engineers and others to experiment with and demonstrate the various methods of applying lighting.

Niagara Falls Will Be Prominent in Jubilee

Following the opening celebration of "Light's Golden Jubilee" at Atlantic City, will come the fifth annual international festival of lights at Niagara Falls on June 13, 14 and 15, when the famous 1,300,000,000-cp. battery which bathes the cataracts will produce new spectacular color effects and special sky drills every night. A municipal airport will be dedicated, "Queen Electra" will head a parade two miles long, in which illuminated floats will depict historical events and industrial progress, and fireworks, street and window decorations and a spectacle to be called "A Night in Venice" will add to the gala spirit.

A reproduction of the first electric lighting generated by falling water at Niagara Falls will be a feature of the celebration, which will be carried out under the auspices of the municipal governments on both sides of the river in co-operation with civic organizations, industries, citizens and the light and power companies.

Purchases and Mergers

Philadelphia Electric and Philadelphia Suburban-Counties to Be Consolidated —Utilities Power & Light Adds to Its English Holdings

PLANS of the Philadelphia Electric Company for consolidation with four of its subsidiaries through exchanges of stock are announced by President William H. Taylor. The merger will bring about unification of the financial structure of companies whose properties are valued at more than $400,000,000. The new company will be called the Philadelphia Electric Company. The companies to be consolidated are the Philadelphia Electric Company, the Philadelphia Suburban-Counties Gas & Electric Company and three gas companies in the vicinity of Philadelphia. Action will be taken by company stockholders on May 27.

The Tennessee Central Service Company, a subsidiary of the Cities Service Company, the Doherty holding organization, has made application before the State Railroad and Public Utilities Commission for the merger of ten public utility corporations, representing more than $10,000,000 worth of holdings in east Tennessee. The merger would include the Bristol Gas & Electric Company, Elk Park Light & Power Company, Newland Light & Power Company, Tennessee Eastern Electric Company, Watauga Power Company and Bluff City Power & Light Company.

No opposition was voiced at the final hearing before Public Service Commissioner Pooley on May 4 on the proposed merger of the Buffalo, Niagara & Eastern Power Corporation, holding company, and the Niagara Falls Power Corporation, the Buffalo General Electric Company, the Tonawanda Power Company, the Niagara, Lockport & Ontario Power Company and the Niagara Electric Service Corporation into one operating company, to be known

as the Niagara Power Corporation. Decision was reserved for action by the full commission at Albany. The total capitalization of the proposed merged corporations will be upward of $215,000,000. The exchange of stock will be share for share.

An ordinance accepting the bid of the Jersey Central Power & Light Company of $285,600 for the electric distribution system of the Borough of Chatham, subject to the voters' approval on June 18, has been introduced in the Borough Council.

The City Council of Emporium, Pa., has plans under way for the disposal of its municipal light and power plant, together with the franchise, to the West Penn Power Company for $250,000. The present plant is not large enough, and if it is found impossible to deal with the West Penn Power, the city officials will immediately arrange for the construction of an addition.

The Worthington Light & Power Company, of which W. F. Bone of Butler was president, has been sold to the Ohio Public Service Company. The deal was made at a figure estimated at $2 per share above par for the stock.

Purchase of the Webster Springs (W. Va.) Water Works & Electric Light Company's hydro and steam generating plant and water properties at Webster Springs has been announced by the Monongahela-West Penn Public Service Company, the transfer having been accomplished early in May. The Monongahela company will operate the properties through a subsidiary, the West Virginia Public Service Company, pending the clearing up of certain titles.

The North Dakota Power & Light Company has purchased the electric light plant at Judson, N. D., from Bruno Just.

The Otter Tail Power Company has purchased the electric distributing system at Newark, S. D. Langford, S. D., has voted to sell its municipal plant to the Northwestern Public Service Company. Lake Norden, S. D., voted almost unanimously to sell its municipal plant to the Union Public Service Company. Pierpont, S. D., voted to sell its electric system and transmission line. Bids are being considered.

The Benton County Utilities Corporation of Joplin, Mo., a Doherty subsidiary, which has operated the Gravette (Ark.) municipal power plant under lease for three years, has offered to purchase it.

No step toward the sale of the Danville (Va.) electric and gas plants will, it is reported, be taken until a commission of 24 persons has made a study of the whole situation. Besides the bid of $3,750,000 from the People's Light & Power Corporation of New York, mentioned last week, the Southern Cities Utilities Corporation of Philadelphia is understood to have bid for the plants.

Winter Garden, Fla., will vote on May 28 upon a proposal to sell the municipal light and water plant to the Florida Public Service Company for $300,000. The company has made a number of previous bids for the plant.

Frank Ralph, vice-president of the Hermiston (Ore.) Light & Power Company, has announced the sale of this utility to the American Engineer & Management Corporation for approximately $100,000. The Hermiston plant has supplied light and power for seventeen years to Hermiston, Echo, Umatilla and Stanfield, a field adjacent to that of the Eastern Oregon Light & Power Company.

The Utilities Power & Light Corporation, through its recently acquired subsidiary, the Greater London & Counties Trust, Ltd., has acquired the Shropshire, Worcestershire & Staffordshire Electric Company, according to a transatlantic telephone message to New York from Harley L. Clarke, president of the Utilities corporation. Among the cities served by the newly purchased company are Birmingham, Smethwick, Dudley, Kidderminster and Bankbury. The purchase price of the ordinary shares of the English company was about $13,000,000, it was reported.

The power plant at Durango, Mexico, has been acquired by interests associated with the Electric Bond & Share Company, and large expenditures are said to be contemplated.

Electrical Engineers Gather at Dallas

Distribution Systems, Oil-Pipe-Line Pumping, Lightning Effects in Transformers, Interconnection and Other Timely Topics Discussed at Institute Meeting

ALTERNATING-CURRENT distribution systems, electrification of oil-pipe lines in the Southwest and the effect of lightning on transformers were subjects which created the most interest at the regional meeting of the American Institute of Electrical Engineers held at Dallas, Tex., May 7 to 9. Among other timely topics covered were interconnection, reclosing high-voltage circuits, remote metering, aviation lighting, railroad signals, telephony, chain broadcasting and electrical features of waterworks. An attendance of 530, which is notably large for a meeting in that section of the country, reflected the enthusiasm of the local Institute members.

An alternating-current network giving standard voltage for both power and lighting was discribed in a paper by John Oram of the Dallas Power & Light Company. This network in fact consists of two separate low-voltage meshes fed from different taps of the same transformers.

The advantages of using bare wire for overhead distribution were brought out in a paper by M. C. Miller of the Texas Power & Light Company. He stated that economies of 5 to 30 per cent are possible by substitution of bare wire for weatherproof wire. He also advised the use of medium-hard-drawn instead of annealed wire. Some of those taking part in the discussion did not agree fully with Mr. Miller, maintaining that the mechanical separation afforded by weatherproof insulation is worth while.

A very interesting account of the status of oil-pipe-line pumping by electricity was given by D. H. Levy of the Magnolia Petroleum Company. This is a tremendous potential field for application of electricity. The costs of electrical pumping, he said, are about equal to those for Diesel-engine pumping, and the electrical equipment has the great advantage that it may be installed in about half the time required for Diesel equipment and is much easier to transport. The load factor of a pumping installation is very high, often well over 90 per cent. Squirrel-cage motors, Mr. Miller said, are usually employed.

Recent researches with natural and artificial lightning were described by F. W. Peek, Jr., of the General Electric Company. He told of studies made with the cathode-ray oscillograph on distribution of surge voltages in transformer windings and showed the desirability of applying electrostatic shields to transformer windings so as to cause an even distribution of voltage under any conditions of wave front.

A review of automatic alternating-current network systems was given in a paper by T. J. Brosman and Ralph Kelly, Westinghouse Electric & Manufacturing Company. E. W. Robinson and S. J. Spurgeon told of the various schemes employed by the Alabama Power Company to maintain service on loops and feeder lines by means of automatic reclosing switches. The great interconnection among the power companies of the Southwest was described by G. A. Mills of the Central & Southwest Utilities Company. This system extends 720 miles from east to west and 810 miles from north to south, having a connected generating capacity of more than 1,400,000 kva.

The lighting of flying fields and airways was covered in a paper by Lieut. H. R. Ogden, U. S. A. A. L. Maillard told of the electrical features of the new Kansas City waterworks. The system of automatic wayside train signals of the Missouri-Pacific System was described by P. M. Gault.

The chain broadcasting of radio programs was treated in a paper by F. A. Cowan of the American Telephone & Telegraph Company. There are eight of these networks in this country tied to 134 broadcasting stations, he said.

Two interesting papers on telephony were presented. H. R. Fritz and H. P. Lawther of the Southwestern Bell Telephone Company told how some of the long-distance problems are being met in the Southwest. Some of the commonly used types of telephone transmission networks were explained in a paper by T. E. Shea and C. E. Lane of the Bell Telephone Laboratories. This paper dealt with the arrangement of wave filters, equalizers, telephone transformers, line-balancing networks and artificial lines.

An attractive feature of the meeting was a lecture on the evening of the first day with demonstrations on the subject of science and research in telephone development. It was given by S. P. Grace of the Bell Telephone Laboratories.

Two student sessions were held at which ten technical papers were read by members of student branches of the Institute. A prize for the best student paper was awarded to Leroy Moffett, Jr., University of Oklahoma, for his paper on "Piezo-Electric Oscillators."

The dinner-dance and various trips of inspection made pleasing interludes.

Economic Changes in Industrial Power

Manufacturing-Plant Survey by National Bureau Shows Increase in Motor Installations, Amount of Purchased Power and Efficiency of Prime Movers

IN A SURVEY by the National Bureau of Economic Research which is now published with the report of the committee on recent economic changes of the President's unemployment conference, increases in the installation of electric motors to supply power in manufacturing, in the amount of power purchased instead of generated by manufacturing plants and in the efficiency of prime movers are mentioned as significant changes in industrial power that have taken place in the last seven years.

L. P. Alford, vice-president of the American Engineering Council, writing in one of the chapters of the survey under the title "Technical Changes in Industry," gives as reasons for the rapid development of electric utility companies the first two of the facts just mentioned and adds: "The increase in the capacity of prime movers which supply power to manufacturing establishments is a rough measure of the increased use of machinery in those establishments. The change whereby the total amount of owned power in manufacturing has decreased but slightly since 1919 and the purchased power supplied through electric motors has increased 12.7 per cent in the same period indicates a shift which is often referred to as 'from a machine civilization created by steam to a machine civilization created by electric power.' The electric motor first appeared as a factor in industrial power in 1899, the amount of power purchased at that time and applied through electric motors being but 1.8 per cent. So rapid has been the increase, however, that in 1925, the last year for which we have statistics, nearly 45 per cent of the power applied in manufacture was by means of electric motors. It is probable that today the total is fully one-half."

Mr. Alford points to the increasing use of purchased power as a trend that would doom the isolated power plant were it not for the fact that much steam is required for processing, a service which cannot, in general, be supplied by the central station. "However," he adds, "the increase in purchased power from 9,284,499 hp. in 1919 to 15,868,828 hp. in 1925 is not only impressive but is indicative of the rate of growth. The effect of this change upon production and productivity cannot be determined. Electric power is making industry more mobile as regards location and is probably contributing to a reduction in prime cost. Unfortunately not much can be said in regard to changes in efficiency as regards the prime movers in use in manufacturing plants. Where new power plants are installed they make use of the most efficient equipment available. But many plants are old and are operating under disadvantageous conditions with low over-all efficiencies."

The report then refers to the obsolescence of the reciprocating steam engine and goes on to say:

"Such new reciprocating engines as are in use are generally of the uniflow type, as this engine gives the economy of the compound engine, yet has only one cylinder and set of reciprocating parts. For certain large industrial establishments where considerable process steam and power are needed, the tendency is toward higher boiler pressures with steam turbines as reducing valves, even with steam mains at more than one pressure intermediate of the boiler, as a maximum, and the lowest process pressure, which is the back pressure of the last turbine, as a minimum.

"Where process steam is not the determining factor and the demand is merely for mechanical power, the choice usually lies between either purchasing from a steam or hydro-electric station distributing system or using oil engines. And when considerations other than that of available power determine the location of a manufacturing plant, so that it is completely out of the reach of the power lines of a central station, the oil engine is now in high favor. These, of course, are normally the smaller plants. The oil engine has also a practical monopoly on the smaller central stations, supplying light and power to towns and villages located far from the transmission lines of large steam or hydro-electric central stations."

The survey and report have been published under the title "Recent Economic Changes" on behalf of the committee by the McGraw-Hill Book Company.

Electric Saturation Far Off

The governmental committee on recent economic changes referred to above was made up of a group of business and labor leaders and economists with Mr. Hoover as chairman. This committee's report was made public on Wednesday of this week. In it, in the course of a survey of the industrial field as a whole with suggestions for further analysis and co-ordination by a permanent central committee, appear these sentences:

"Important as is the development of the economic side of our national life, through invention and discovery of new industries and new callings, an illustration of the potentialities of further lifting the national standard of living, without developing another invention or discovery and without creating a new want, can be drawn from a single industry—that of electrical appliances. A home or farm wired for electricity is a different economic unit from one which is not wired.

"In 1928 apparently a large percentage of the homes wired for electricity had electric flatirons; less than one-third of them had washing machines; slightly over one-third of them had vacuum cleaners; less than 5 per cent had electric refrigerators. We are far from the saturation point in connection with any of these devices. On January 1, 1928, there were 7,500,000 radio sets in use. Yet about 70 per cent of American homes are still without the radio. We seem only to have touched the fringe of our potentialities."

Coast-to-Coast Commercial Radio Service

Last Wednesday, May 15, was the date of the opening of a New York-San Francisco commercial radio-telegraph service by the R. C. A. Communications, Inc. Messages were accepted in New York, Boston and Washington for transmission to San Francisco, and vice versa, at the same rates which apply to land-wire telegraph service.

The new service, which includes photo-radio transmission as well as messages, is the first step in a plan for establishing a nation-wide domestic radio system, acording to General James G. Harbord, president of the Radio Corporation of America and of R. C. A. Communications, Inc. An application is now pending before the Federal Radio Commission at Washington for short-wave frequencies sufficient to serve 30 cities in an inland network of radio communication.

Interstate Power Transmission in Communications Bill?

Legislation is necessary to allow radio broadcasting to attain its proper development, Ira A. Robinson, chairman of the Federal Radio Commission, told the Senate interstate commerce committee during its resumption of hearings on the Couzens Communications Commission bill. It would be well to give over to such a commission the radio activities of the Commerce Department, he said. Judge Robinson also expressed the opinion that the proposed commission, rather than the Interstate Commerce Commission, would be a proper agency to regulate the transmission of power. Senator Couzens, who contemplates adding an interstate power-transmission clause to his bill, at this point reminded the committee that Section 31 of the existing act mentions power as coming under its provisions. Senator Dill explained that this reference to power was included only in anticipation of the transmission of energy without wires. On behalf of the National Association of Railroad and Utilities Commissioners John E. Benton said that the power-regulating amendment will be of interest because of its possible bearing on state regulation.

Regarding the advisability of classifying broadcasting stations as public utilities, Judge Robinson said that he sympathizes with this point of view. It was indicated, however, that there are practical difficulties in the way.

Louisville Program Especially Fine

East Central Convention Addressed by Group of Excellent Speakers —Utility Publicity Defended—Future Development of Central-Station Electricity Supply

A SERIES of addresses and papers that ranged through the important activities in the central-station business and that must have been an inspiration to their hearers characterized the convention of the East Central Division of the National Electric Light Association at Louisville, on May 7 to 10 inclusive. Probably the most important message was that presented by Martin J. Insull, who unequivocally asserted his faith in publicity as the means for laying the foundation of public understanding on which the utility industry must stand. Such publicity should cover every utility activity from the technicalities of production and distribution through management and finance. Consolidations and mergers are becoming so frequent as to be confusing and suspected, and complete candor on these operations is essential, Mr. Insull declared.

P. S. Arkwright reiterated the logical and well-expressed justification of the electrical utilities in the eyes of the nation which has made his presidency of the N.E.L.A. stand out. Managing Director Clapp followed Mr. Arkwright with a comprehensive picture of the contributions of the electric utilities to the prosperity and progress of the United States.

The accountant had his day in court through two able representatives, Dr. John T. Madden of the University of New York and J. H. Lobban of the Detroit Edison Company. Concerning machines for billing and other accounting duties Mr. Lobban said that their use was not necessarily desirable for economy but for speed, because the value of accounting information is essentially a news value existing here and now. Dr. Madden predicted the disappearance of the prejudice against non-voting common stock and the acceptance of this form of security for trading on the New York Stock Exchange within five years. He ridiculed the idea of utility propaganda or any other interested effort affecting the opinions or teachings of educators.

In an excellent address Prof. A. G. Christie of Johns Hopkins University discussed "Power Generation, Present and Future." Professor Christie indicated the probable development of power-plant apparatus and devices in detail as they appear to him from present tendencies. A theoretical set-up, departing in only slight degree from ideas and equipment of the present, which would produce a kilowatt-hour for 8,000 B.t.u. was thought by the speaker to be something that might be confidently expected reasonably soon. He predicted a lessening of the importance of vacuum for exhaust reception and said that higher entrance steam pressures would allow higher outlet back pressure and thus remove from steam operation the requirement of large volumes of cooling water. The processing of fuels for recapture of their byproducts and the extension of central-station services through the sale of steam for heating and industrial work are indicated in the near future. A better utilization of fuel through power interchanges between industrial concerns and central stations is also not far off.

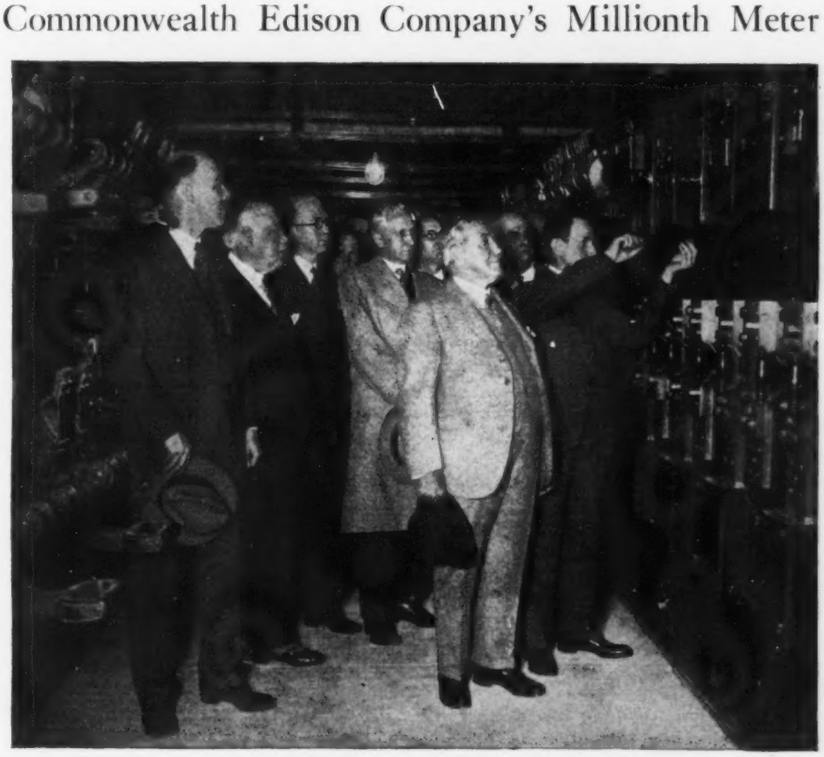
In response to his own question "Can We Make Rural Electrification Pay?" Charles F. Stuart came forward with an emphatic affirmative. He said that rural service can now be talked about in terms of dollars and cents, as well as in terms of public relations, which until lately was the only language for it. The same optimistic feeling was shown by Dr. E. A. White, who said that complete rural electrification waits only on the general improvement of the farmer's economic condition.

Prof. G. W. McCuen of Ohio State University asserted that the trends toward mechanization in the development of farm operating practices are resulting in a decline of the ratio of farm to urban population. He presented a series of different rates for rural service and the prices per kilowatt-hour which would result from them as applied to the Ohio experimental lines. Although the different rates were very diverse in form and statement, yet in the final analysis there was comparatively small divergence between them in the actual prices per kilowatt-hour, particularly for large consumptions of energy.

National commercial plans and programs were explained by C. E. Greenwood, who asserted that electrical merchandise must be produced and sold with a price appeal to two different classes of buyers. In one class are those to whom price means little and who insist upon appearance and novelty. In the other and much larger class price is the most important consideration, but appliances made for this market must not be reduced in quality as affecting performance.

An address on the technique of salesmanship was made by W. R. Braasch, president of the Salesmanship Foundation. J. C. Langdell spoke on domestic electric water heating, holding that this load must be built up on the condition of off-peak service and rates and that for real volume in it the kilowatt-hour rate must be down to at least one cent. Public speaking as an activity for central-station employees was championed by W. S. Vivian, national committee chairman; E. H. Sniffen of the Westinghouse company said that no other thing had so good a domestic selling appeal as electric service and advo-

Commonwealth Edison Company's Millionth Meter



CHICAGO boasts one installed electric meter for every three and one-tenth persons. When meter No. 1,000,000 of the Commonwealth Edison Company was installed this month in the new plant of the Chicago *Daily News* by P. J. Smith, superintendent of the company's service and repair department, Vice-President L. A. Ferguson, W. L. Abbott, chief operating engineer and Homer E. Niesz, manager of industrial relations, looked on, as did James L. Houghteling and Irving Stone of the *Daily News* and John Root, architect.

cated intensive selling practices; Dr. J. Slepian, also of the Westinghouse company, described the new Deion circuit breaker; H. M. Towne of the General Electric Company spoke on the development of the lightning arrester; M. F. Smalley, Ohio Power Company, presented an excellent paper on the rating of meter capacities to residential loads, and Alexander Maxwell spoke on wiring codes and standards.

Officers elected were: President, L. V. Herrington, president Kentucky Utilities Company, Louisville; first vice-president C. H. Hardesty, Monongahela-West Penn Public Service Company, Fairmont, West Va.; second vice-president, G. E. Miller, Cleveland; third vice-president, C. L. Proctor, Toledo (Ohio) Edison Company.

Further Events of Asheville Southeastern Meeting

President Arkwright's address at the convention of the Southeastern Division of the National Electric Light Association, held at Asheville, N. C., and reported briefly last week, contained a tribute to the rapid progress of the South. He said that the Southeast had led the nation in percentage of increase in production and use of electric power during the past five years.

Among addresses not reported last week was one by Harry M. Hitchcock of *Printer's Ink*, who told the convention he thought the prime cause of misunderstanding between the power company and its customers was the fact that the power company considered itself a manufacturer while the customer looked upon it as a retailer. It was his opinion that advertising was the medium to weld the different viewpoints. Stewart L. Mims, vice-president J. Walter Thompson Company, with the use of slides presented the convention with certain of the information gleaned by that company in its market development survey for the electrical industry. Mr. Mims' talk ranged around "woman power" in the home, rather than man power in industry, and showed the market development possibilities in the homes already connected to central-station lines.

Dr. Gus Dyer, dean of business economics, Vanderbilt University, in an able address, said that the people of this country were no longer afraid of "big business" because through customer ownership of securities big business was big only in the sense of the volume of business done. He touched also on the decentralization of industry and what this would mean to the Southeast. John G. Jones of the Alexander Hamilton Institute thought that the seeming decentralization of industry was really local development which was making new industrial centers.

Talks at the section meetings included one to the Engineering Section by L. W. W. Morrow, editor ELECTRICAL WORLD, on "Utility System Planning," and one by F. V. Andreae, Southern Manganese Corporation, concerning future growth in the field of the electrochemical industry. A. Edwin Fein addressed the Commercial Section on the subject of merchandising psychology, while Fred W. Herbert of the N.E.L.A. addressed the Accounting Section meeting. Miss Mamie Kennedy of the South Georgia Power Company, Albany, won the women's public-speaking contest.

The following officers were elected for the coming year: President, T. H. Tutwiler, president Memphis Power & Light Company; first vice-president, H. E. Cox, Birmingham Electric Company; second vice-president, J. V. Strange, Carolina Power & Light Company, Raleigh; third vice-president, J. C. Guild, Tennessee Electric Power Company, Chattanooga.

Power Exportation Still Agitates Canada

Quebec Power Used in Ontario Not Re-exported, Magrath Says—Slave Falls Lease Ready—Rural Line Progress—New Brunswick Rate Agreement

DEFINITE assurance that the Ontario Hydro-Electric Power Commission is not taking advantage of power imported from the Province of Quebec for purposes of re-export to the United States was given in a letter from C. A. Magrath, chairman of the commission, presented in the Canadian Senate during consideration of the bill amending the electricity and fluid exportation act. The letter read in part as follows:

"The question of exporting power from this province is more or less academic, because, as you know, we have been buying power in the Province of Quebec. I am aware that some concern has been expressed as to the commission indirectly making use of power from the Province of Quebec for export purposes. I believe that the government of the Province of Quebec is satisfied that that is not being done. In respect to the export from Niagara Falls of firm power, the Ontario Power Company, controlled by American interests, made a contract for the export of 60,000 hp. a few years before Parliament passed an act in 1907 bearing upon the exportation of electricity. When this commission was negotiating for the purchase of the Ontario Power Company, it endeavored to have the contract, expiring in 2010, canceled. It, however, succeeded in, having the date brought back to 1950. In other words, that contract will expire in a little over twenty years' time."

A bill has just been introduced in the Manitoba Legislature confirming the lease to the city of Winnipeg of the Slave Falls site on the Winnipeg River, which the city hydro will develop. The policy of the provincial government is that of applying revenues from the water powers on the Winnipeg River to bonusing transmission lines of the provincial hydro system to serve other districts of the province. To this Winnipeg strenuously objected. The compromise agreed on will limit the increase in rentals to 50 cents per horsepower annually.

An extensive program of rural distribution is to be undertaken by the Ontario Hydro-Electric Power Commission this year. It is proposed to build more than 1,000 miles of primary lines in addition to the 4,000 miles already constructed. These additional lines will serve more than 6,000 rural consumers and will cost approximately $2,500,000. There are at present more than 377 miles of lines constructed or about to be constructed, which will serve 1,400 additional consumers and will cost approximately $835,000. Northern, eastern and southeastern sections of the province are included in this work of extension.

Negotiations which have been going on for some time between the New Brunswick Electric Power Commission and the New Brunswick Power Company toward a modification of the existing contract between these two bodies, particularly in regard to the rate charged by the company for energy supplied to the commission, were brought to a successful conclusion on May 10. It is reported that, under the price agreed to, the commission will save this year $45,000 on energy purchased from the company. The price of the energy under the revised agreement is to be 1.25 cents a kilowatt-hour for the first 3,000,000 kw.-hr., instead of 1.75 cents, and 0.56 cent for all over that amount instead of 1.5 cents.

Federal Power Commission Applications

The Sierra Pacific Power Company of Reno, Nev., has applied to the Federal Power Commission for a license covering a transmission line in Nevada, Sierra and Plumas Counties, Calif. It is planned to construct a three-phase line, 41 miles long, to operate at 60,000 volts and connect an existing line of the applicant with Loyalton.

The Cloverdale Mines Company of Hillside, Colo., has applied for a license covering a small diversion dam in Lake Creek, in Custer County.

The Sierra Pacific Power Company of Reno, Nev., has applied for a license covering a transmission line to connect an existing line of the applicant with Camp Richardson, on the south shore of Lake Tahoe. The line will be 17 miles long.

The Idaho Power Company has applied for a license covering a constructed transmission line from the applicant's Caldwell-Nyssa-Ontario line to the town of Vale, Ore., a distance of 14 miles.

M. J. Plasse of Jackson, Calif., has applied for a license covering two small diversion dams in an unnamed tributary of Silver Lake in Amador County, Calif. The power will light an amusement park.

The Mountain States Power Company of Albany, Ore., has applied for a license covering a constructed transmission line 40 miles long, extending

from the Boysen dam in Wind River Canyon to Shoshone and Riverton, Wyo.

The California-Oregon Power Company has applied for a license covering a constructed transmission line 36 miles long extending from Montague to Etna, Calif.

Briefer News

EVANSVILLE COMPANY'S BIG SIGN.—What is said to be the largest electric sign in Indiana is being erected on the new plant of the Southern Indiana Gas & Electric Company at Evansville, Ind. It will bear only the inscription "S. I. G. and E. Company," in letters 14 ft. high, inclosed in a double border. Nearly a thousand 25-watt lamps will be used.

SHREVEPORT, LA., TO ENJOY LARGE REDUCTION IN RATES.—An agreement between the Southwestern Gas & Electric Company and the city of Shreveport, La., for reductions in electric service rates totaling at least $140,000 annually has been reached and is expected to gain approval from the Public Service Commission.

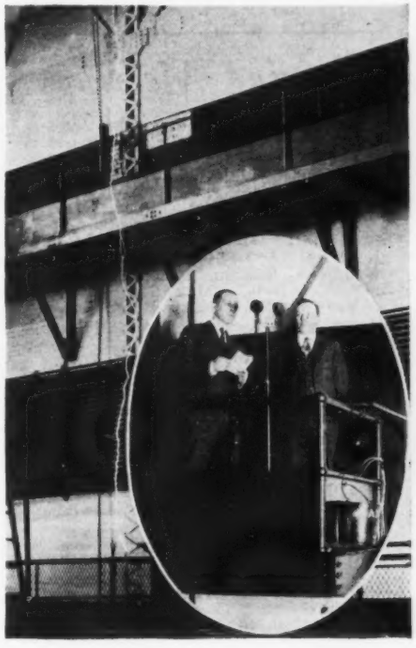
LOS ANGELES GAS & ELECTRIC BEGINS WORK ON PASADENA OFFICE.—Work has started on the construction of the new district office building of the Los Angeles Gas & Electric Corporation to be built on the civic center of Pasadena opposite the city hall. The building, which will cost approximately $200,000, is expected to be ready late in the year.

APPALACHIAN COMPANY INSTALLS ELECTRIC HEAT IN ONE OF ITS OFFICE BUILDINGS.—An electric heating system has been installed by the Appalachian Electric Power Company in its new office building at Pulaski, Va., an architecturally attractive two-story light-texture brick and glass building, just formally opened to the public. The heating system will serve the purpose of experimentation in such installations.

MANITOBA ELECTRICAL ASSOCIATION REVIEWS YEAR OF SUCCESS.—Organization of the "red seal" plan, a large increase in membership and excellent financial condition were given in the thirteenth annual report of the Manitoba Electrical Association, presented by the retiring president, Fred J. Malby, at the annual meeting held May 3 at Winnipeg, as reasons for gratification. Maurice C. Gilman was elected president for the coming term and E. C. Banks secretary.

MORE BOULDER DAM BILLS.—Representative Taylor of Colorado has introduced a bill specifying confirmation of the allocation of 7,500,000 acre-feet of water annually to the four states in the upper basin of the Colorado River and 8,500,000 acre-feet to the lower basin states. Mr. Taylor says that his bill is a necessary supplement to the Boulder Dam act, as finally and definitely affirming the allocation as between the two basins by act of Congress. He has introduced also a companion bill giving the sanction of Congress to the negotiation by the four upper basin states of a compact allocating among themselves the 7,500,000 acre-feet which has been accorded the upper basin.

RADIO LISTENERS HEAR ARTIFICIAL THUNDER.—Crashes of artificial thunder, produced by the new 5,000,000-volt lightning generator in the high-voltage laboratory of the General Electric Company at Pittsfield, Mass., were heard by radio listeners recently during a talk



by F. W. Peek, Jr., consulting engineer of the General Electric Company, from station WGY. The photograph shows one of the high-voltage sparks jumping a needle gap in the laboratory. In the inset are the announcer (left) and Mr. Peek.

MICHIGAN PUBLIC SERVICE COMPANY'S CONSTRUCTION PROGRAM.—A new construction program involving an ultimate expenditure of approximately $100,000 has been started in Leelanau County, Mich., by the Michigan Public Service Company, according to announcement by Vice-President W. A. Wadsworth. The main item will be a new power line from Sutton's Bay to Northport and Northport Point. This is expected to be completed about June 1. An automatic substation is to be built at Northport.

SOUTHERN CALIFORNIA EDISON PUSHES NEW UNIT FOR LONG BEACH.—Shipments of electrical equipment for the coming 100,000-kw. addition to the Southern California Edison Company's steam generating plant at Long Beach will begin early next month. When the new unit, which will duplicate the one placed in operation last year, goes into service early in 1930 it will bring the present system capacity of steam and hydro to well over a million horsepower. Ultimate plans embrace a series of eight units of like capacity, at a cost of $100,000,000, providing a total rating of 800,000 kw.

N.E.M.A. BACKS NATIONAL FOOD PRESERVATION COUNCIL.—At the first meeting of the executive committee of the new Refrigeration Division of the National Electrical Manufacturers' Association, held in Cleveland on May 7, it was announced that $170,000 has been pledged by manufacturers of domestic electric refrigerators for participation in the program of the National Food Preservation Council. The estimated minimum total for this fund is $200,000. The co-operation of finance companies, including the Morris Plan, is expected in connection with local newspaper advertising.

MISSOURI MUNICIPAL UTILITY OFFICIALS OPTIMISTIC.—That Missouri's municipally operated light and power plants and other municipal public utilities are being operated profitably was the general opinion expressed by speakers before the Missouri Association of Municipal Utilities at Fulton, Mo., on May 7 and 8. President Edgar C. M. Burkhardt of Macon and other speakers declared that public opinion in municipalities with publicly owned utilities is decidedly against their sale to private corporations because they are paying dividends, liquidating public debts and retiring bonds from earnings.

TENNESSEE COMMISSION PROTESTS AGAINST EMBARGO ON RIVER DEVELOPMENT.—Protests against the continued removal of the Upper Tennessee River from development have been lodged with members of Congress and with various federal agencies by the Tennessee Railroad and Utilities Commission. Its members express particular disapproval of the plan for the disposition of Muscle Shoals set forth in the revised Madden bill. The commission believes that, with minor exceptions, Tennessee's interests would be best safeguarded were there no interference on the part of Congress with the operation of the water-power act as it pertains to the development of the Upper Tennessee.

MORE RATE INVESTIGATION FOR ALABAMA POWER COMPANY.—A general investigation into all of the rates of the Alabama Power Company and a further investigation into the Mitchell Dam properties of the company have been ordered by the Alabama Public Service Commission. This order supplements a former one authorizing an investigation into the commercial rates of the power company and will probably involve street-lighting rates and rates for retail power users. Hearing is set for June 11. The commission says, however, that, inasmuch as it recently

revised the rates for residential service after several months of investigation, it is not contemplated that any further substantial revision of these rates will be found necessary now.

NEW ORLEANS' MILLION-DOLLAR LIGHTING PROGRAM.—Plans for improved lighting in New Orleans have reached the stage where W. T. Hall, commissioner of public utilities, has put a million-dollar program before the city's Commission Council. It covers both business and residential sections. Canal Street merchants will pay only $20,000 instead of the $100,000 originally expected, the cost of standards being borne by the contractor according to the ordinance. A special type of antique standard in keeping with its atmosphere will be used in the historic Vieux Carré. The four-block approach along North Rampart Street to New Orleans' new municipal auditorium will have the same type of standards as Canal Street, with slightly less illumination.

APPEALS FOR RADIO ENGINEERS' CO-OPERATION.—Declaring that "man-made interference is growing in its relative importance as an obstacle to the service value of broadcast reception," Edgar H. Felix, radio consultant of the National Electrical Manufacturers' Association, in an address before the recent national convention of the Institute of Radio Engineers at Washington, urged co-operation with the electrical manufacturing industry in eliminating electrical interference. "No progress whatever has been made in fixing the responsibility for radio silence upon the makers of interference-creating equipment," Mr. Felix said. "The radio engineer must exert his influence in electrical standardization. Instead of viewing the electrical industry as competitive or dissociated, he must work hand in hand with the appliance, power and traction engineers."

MODESTO IRRIGATION DISTRICT SEEKING FOR ENERGY.—Refusal of the two major power companies serving the San Joaquin Valley to furnish the Modesto Irrigation District with standby service is to be met by the district with an appeal to the California Railroad Commission to compel either the Pacific Gas & Electric Company or the San Joaquin Light & Power Corporation to furnish the required service. In the meantime the district has advertised for bids to be opened May 27 for the installation of the first unit of a generating plant. This unit will represent about one-fifth of the ultimate development of 7,500 hp. Reports from Modesto state that the district will need the additional power next fall, when the irrigation season is over and the winter shortage of water develops. The district obtains its power of approximately 15,000 kw. from the Don Pedro Dam, on the Tuolumne River. It receives the water that has gone through the Hetch Hetchy plant of San Francisco at Moccasin Creek and has made efforts to obtain standby power from that plant.

NEW YORK EDISON ATTACKED ON MATTER OF A.C. OR D.C.—Charges that the New York Edison Company is attempting to force construction companies to use alternating instead of direct current, involving the discarding of hoisting equipment valued at hundreds of thousands of dollars, and that other building trades are similarly affected, are probably to be made the basis of an appeal to the Public Service Commission by the Structural Steel Board of Trade in New York City, of which Charles L. Eidlitz is attorney and chairman. The steel men assert that the New York company has reversed its attitude and that, whereas formerly it persistently urged users of power in the city to buy direct-current motors, on the ground that they were more efficient, more easily controlled and better in every way for all types of work, it now contends that it has not sufficient direct-current supply to take care of the load requirements.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for January 5, page 80.]

National Electrical Manufacturers' Association — The Homestead, Hot Springs, Va., May 20-25. S. N. Clarkson, 420 Lexington Ave., New York.

Nebraska Section, N.E.L.A. — Scottsbluff, Neb., May 24. Thorne Browne, 1527 Sharp Bldg., Lincoln.

American Electrochemical Society—Toronto, May 27-29. C. G. Fink, Columbia University, New York.

National Electrical Wholesalers' Association—The Homestead, Hot Springs, Va., May 27-31; Pacific Division, Del Monte, Calif., June 13-15. E. Donald Tolles, 165 Broadway, New York.

National Electric Light Association—Atlantic City, N. J., June 3-7. A. J. Marshall, 420 Lexington Ave., New York.

Artistic Lighting Equipment Association—Hotel Chelsea, Atlantic City, June 5-7. G. P. Rogers, 420 Lexington Ave., New York.

North Central Electric Association—Breezy Point, Pequot, Minn., June 16-18. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Association of Iron and Steel Electrical Engineers—Pittsburgh, June 17-21. J. F. Kelly, 1007 Empire Bldg., Pittsburgh.

Canadian Electrical Association — Algonquin Hotel, St. Andrew's by the Sea, N. B., June 19-21. H. M. Lyster, 712 Power Bldg., Montreal.

Pacific Coast Electrical Association—Del Monte, Calif., June 19-22. S. H. Taylor, 447 Sutter St., San Francisco.

Society for the Promotion of Engineering Education—Ohio State University, Columbus, June 19-22. F. L. Bishop, University of Pittsburgh, Pittsburgh.

Wisconsin Utilities Association — Accounting Section, Sheboygan, June 20-21; Electric Section, Wausau, July 18-19. J. N. Cadby, 432 Broadway, Milwaukee.

American Institute of Electrical Engineers—Swampscott, Mass., June 24-28. F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials—Chalfonte-Haddon Hall, Atlantic City, June 24-28. C. L. Warwick, 1315 Spruce St., Philadelphia.

Northwest Electric Light and Power Association—Seattle, June 26-29. B. Snow, 1206 Spalding Bldg., Portland, Ore.

Michigan Section, N.E.L.A.—Mackinac Island, July 1-3. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

American Society of Mechanical Engineers—Salt Lake City, July 1-4. C. W. Rice, 29 West 39th St., New York.

CAMPBELL RIVER, B. C., ATTRACTS ANOTHER BIDDER. — The Strathcona Power & Pulp Company, incorporated at Victoria, British Columbia, has been added to the companies that have filed water rights on the Campbell River Falls, Vancouver Island. (See ELECTRICAL WORLD for February 23, page 413.) Both public utility development and pulp and paper manufacture are concerned. Rights will be awarded in May, it is announced.

GREEN MOUNTAIN SYSTEM EXPANDS IN VERMONT.—Improvements aggregating $500,000 in cost are scheduled for early construction on the system of the Green Mountain Power Corporation, Burlington, Vt. A steel-tower line about 27 miles long with aluminum conductors will be built between the Essex hydro-electric station east of Burlington and the Middlesex plant near Montpelier, the line being insulated for 66-kv. ultimate operation. Initial operation will be at 33 kv. A 22-kv. extension of the present Vergennes line will be made to facilitate feeding energy into Burlington for lighting and power service. At the Gorge steam plant near Burlington oil-burning equipment will be installed, with superheaters for the boiler units. A tie line will shortly be built between the Mackville plant of the company and the Morrisville municipal plant to enable the purchase of surplus hydro-electric energy from the latter. Oil burners are now being installed at Mackville and switching and substation improvements are on the construction docket.

INSULL COMPANY FIGHTS COMMISSION OVER MARTINSVILLE (IND.) VALUATION.—A temporary injunction restraining the Indiana Public Service Commission from enforcing an order affecting the rates of the Wabash Valley Electric Company at Martinsville has been issued by the federal court at Indianapolis. The commission recently laid down the rule that only local property of direct usefulness in serving electrical consumers could be capitalized in the rate base. A value of $87,000 set by the commission on the Martinsville property of the company, an Insull utility, is $9,000 less than the book cost of the property, the company alleges in charging confiscation. The company, which regards this as a test case, sought a valuation on all the property of the Wabash Valley company serving numerous other communities and asked that a proportion of the value on all property be allotted to Martinsville on a basis of customers and kilowatt-hours of consumption in that city. It also asked that proportionate costs of power transmission lines connecting the Wabash Valley company with other companies of the Insull system be allotted against the Martinsville consumers. The commission declined to make either form of allotment.

GREAT LAKES & ATLANTIC CANAL & POWER COMPANY LOSES OUT AT OTTAWA.—The application of the Great Lakes & Atlantic Canal & Power Company for authority to build a power and transportation canal paralleling the St. Lawrence system to Cornwall was voted down in the Canadian House of Commons recently without a single vote in its favor, the Minister of Railways and Canals opposing it. In the bill it was set out that if the promoters did not spend $10,000,000 within two years the authorization should be null and void.

PARKERSBURG-RIVESVILLE (W. VA.) 132-KV. LINE UNDER WAY.—Rights-of-way for a 132-kv. power line from the Riverside power plant of the Monongahela-West Penn Public Service Company at Parkersburg, W. Va., through North End and to south Parkersburg, and for a 100-mile line from Parkersburg to Rivesville are complete, and work is being pushed rapidly on both lines. Surveys for the Rivesville line were completed some time ago and rights-of-way are being cleared now preparatory to actual construction work by Sanderson & Porter of New York. The total cost is estimated at $1,500,000, including a new substation on the Northwestern Turnpike.

MAY MEETING OF ELECTROCHEMISTS IN TORONTO.—The University of Toronto will be headquarters for the American Electrochemical Society when it meets in the Canadian city on May 27-29. "Electromagnetic Characteristics of Electrochemical Processes" will be the subject of the first session. Discussions, symposiums and addresses will include as themes Canada's electrochemical industries, modern methods in teaching electrochemistry, nitrogen fixation, electric furnaces, electro-reduction, corrosion and electrodeposition. Walter von Hohenau of Brazil will give an address, with experimental demonstration, on "Rearrangement of Atomic Structures Through Electromagnetic Vibrations."

MARYLAND COMPANIES FIGHT OVER TERRITORY.—The fight between the Suburban Electric Company and the Consolidated Gas, Electric Light & Power Company for territory in southern Maryland—a contest which has aroused great local interest—has been reopened, the Maryland Public Service Commission having begun a new hearing on May 7, although it had previously made a decision in favor of the Consolidated. A promise that no section of southern Maryland would suffer by the extension of the lines of the Consolidated into Chesapeake Beach and North Beach was made at the hearing by President Herbert A. Wagner. An early decision is promised by the commission, which is also on May 27 to take up the question of reductions in the electric and gas rates of the Consolidated, a cut totaling $500,000 a year being predicted.

Recent Court Decisions

CONDITIONS GOVERNING RECOVERY BY ELECTRIC COMPANY FROM TELEPHONE COMPANY WHERE RESPONSIBILITY FOR ACCIDENT IS SHARED.—A shopkeeper was killed when he touched an appliance in his store supplied with power by the Derry Electric Company. The latter sued the New England Telephone & Telegraph Company to recover the sum paid in damages on the ground that the telephone company had negligently pulled wires originally safe into a dangerous position. The Circuit Court of Appeals in New Hampshire held that such a suit could be granted only if the electric company itself was guiltless of any negligence except that of failing to discover promptly the alteration in the wiring. Sustaining a finding for the defendant, the court said that the jury's duty, clearly explained, was to decide whether between the two companies the telephone company was solely to blame, and the evidence of active negligence by the telephone company was so slight and unsatisfactory that it scarcely made a case of enough weight to be submitted to the jury. (31 Federal [2d] 51.)*

RIGHT OF MUNICIPAL PLANT TO EXTEND SERVICE BEYOND CORPORATE LIMITS.—Granting to the New York Central Electric Corporation an injunction restraining the Village of Castile from extending its transmission lines outside the corporate limits and into territory claimed by the company, the New York Supreme Court said: "The defendant's right to extend beyond the village of Castile exists by virtue of the village law. The right to make such extension, however, must be with the consent and approval of the Public Service Commission, if there is another company furnishing light within the territory into which such system is proposed to be extended. There is no dispute but that the plaintiff is furnishing light to inhabitants in the town of Castile; that it is extending its lines so as to furnish light and power to inhabitants not heretofore accessible. There is no claim that the defendant has obtained the consent of the Public Service Commission to extend its lines. There is no claim that it has received the consent of the town authorities to erect poles and string wires in and along the streets and highways of the town."

OWNER OF UTILITY NOT BOUND BY CONTRACT MADE BY PREVIOUS OWNER.—A decision handed down by the Ohio Supreme Court supports two lower courts in finding that new owners of a power company are not bound by contracts made before they gained possession of the utility. These decisions were given in two suits filed by the Ohio Public Service Company. One was against the General Light & Power Company and the other against Everett W. Sweezy, president of the Suburban Light & Power Company, holding company of the General Light & Power Company. Both were to require the General Light & Power to operate according to an agreement signed with the Ohio Public Service Company. When the General Light & Power was formed lines were constructed and a contract entered into for the purchase of electricity from the Ohio Public Service Company. This contract, in addition, set down certain boundaries outside of which the company was not permitted to construct new lines. About two years ago Mr. Sweezy purchased the Suburban Light & Power and its associated companies. An extension program was launched by the General Light & Power Company beyond the limits provided in the contract, and the Ohio Public Service sued, claiming that the company intended to violate its contract in the erection of new lines and planned to connect with the Stark Electric Railroad Company, then owned by Mr. Sweezy.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

WHEN CONDEMNATION PROCEEDINGS ARE DISCONTINUED CITIES BEGINNING THEM MUST REIMBURSE UTILITIES.—Cities and towns which begin proceedings to condemn utility properties and then fail to carry the proceedings to a conclusion are bound to pay the expenses incurred by the utility in opposing the proceedings. This is the effect of a decision rendered by the California Railroad Commission. In 1922 the city of Stockton brought proceedings against the Pacific Gas & Electric Company to condemn the waterworks in Stockton, then owned and operated by the company. The commission fixed the value of the property, but the proponents of municipal ownership were unable to get the voters to approve their plan to buy out the company. The city paid its own expenses for engineering and legal experts. Then the company made the claim that, under the public utilities act, it was entitled to be reimbursed for all money it had expended for the services of attorneys, engineers and other experts in defending the case. The commission found in its favor.

VERMONT COMMISSION DENIES PLEA OF OUTSIDE CORPORATION FOR PERMISSION TO DO BUSINESS WITHIN STATE.—Unless it can be fairly shown that marked benefits will result to the public from a transfer of all assets of a domestic utility to a foreign one, the public good will best be promoted by keeping local corporations domestic, in view of the limited jurisdiction of the commission over the securities of foreign companies. This decree was made by the Vermont Public Service Commission in denying to the Public Utilities Vermont Corporation a certificate to permit it to do business within the state and to the Clyde River Power Company permission to sell its properties to the organization first named. The Public Utilities Vermont Corporation had failed to keep its accounts in conformity with a statute requiring that each item of property should be carried in the fixed capital accounts at no more and no less than its actual cost, and the commission declared: "We have thrice agreed with the Foshay company's contention that operating utility companies in this state should be domestic corporations, and we find no reason on the record of this case for departing from this principle. On the contrary, the loose and irregular accounting methods of the Public Utilities Vermont Corporation, revealed in this case, argue strongly against the state relinquishing any degree of control over this corporation."

News About Men of the Industry

Tutwiler New President of Southeastern Division

Thomas H. Tutwiler, president of the Memphis Power & Light Company, was elected president of the Southeastern Geographic Division of the National Electric Light Association at the convention held recently in Asheville, N. C. Mr. Tutwiler's public utility career has been spent almost entirely in the South with the exception of a short period in Kansas City, Mo., when he engaged in changing the cable system of transportation service to the electric railway system. A native of Virginia, he first was occupied in the railroad industry for several years before he entered the employ of the Birmingham Street Railway System in 1901. From 1903 to 1904 he was in charge of rehabilitating the Nashville Street Railways and the year 1905 found him occupying the position of vice-president and general manager of the Memphis Street Railway Company. One year later he became president and general manager. In 1923 he was named, in addition, president of the Memphis Power & Light Company. Mr. Tutwiler is actively identified with the American Electric Railway Association and other engineering societies.

M. T. Lothrop President of Timken Roller Bearing

At a meeting of the board of directors of the Timken Roller Bearing Company recently Marcus T. Lothrop was elected president of the company, succeeding H. H. Timken, who becomes chairman of the board.

Mr. Lothrop started with the Timken Company in 1911 as metallurgist, and for the past eighteen years has been intimately connected with its affairs, being closely associated with H. H. Timken. During that time he has been engaged in various capacities, successively, in metallurgy, research, in charge of operations and, for the last few years, as vice-president and general manager in charge of all operating and sales.

FRANK W. SMITH, vice-president and general manager United Electric Light & Power Company, New York, has been elected to the presidency of the Brush Electric Illuminating Company and LAWRENCE A. COLEMAN, vice-president in charge of commercial relations of the New York & Queens Electric Light & Power Company, became vice-president of this pioneer lighting company. The Brush Electric Illuminating Company did the first arc lighting business in New York City during December, 1880.

J. L. MANGE, president of the Associated Gas & Electric Company, has been elected a director of the Rochester Gas & Electric Corporation. The Associated interests recently acquired the Rochester corporation.

L. A. PETTIT, JR., formerly vice-president of the Missouri Power & Light Company, has been appointed vice-president in charge of operations of the United Power & Light Corporation, which serves the principal cities of central Kansas.

L. B. Herrington Heads East Central Division

Lewis B. Herrington, who has been prominently identified with Kentucky utilities for a number of years, was elected president of the East Central Geographic Division of the National Electric Light Association at the convention held last week in Louisville. Mr. Herrington was the natural choice to head this division, having a thorough knowledge of utility and industrial conditions in the states included. A native of Albany, Ga., and a graduate of Central University, Richmond, Ky., and of Mercer University Law School at Macon, Ga., Mr. Herrington entered the public utility field in 1904, when, with associates, he built the electric light and power plant at Richmond. Later he and his friends operated an electric light and power system in Ohio and the telephone utility at Orlando, Fla., all these companies later being sold and the Richmond property becoming part of the Kentucky Utilities Company system.

Mr. Herrington was the originator of the plan to develop the hydro-electric power plant on the Dix River and the accomplishment of this plan was realized through his strenuous efforts to attract to the project men with sufficient resources to insure its success. He has been connected with the Kentucky Utilities Company for fourteen years. Mr. Herrington has served two terms in the Kentucky Legislature and he has an extensive acquaintanceship throughout the state.

C. N. Lauer Becomes Vice-President of U.G.I.

Conrad N. Lauer has been elected a vice-president of the United Gas Improvement Company and president of the Philadelphia Gas Works Company, to succeed Paul Thompson, retired after more than thirty years in U.G.I. service. Mr. Lauer also has been appointed a member of the Philadelphia Gas Works Commission, succeeding Mr. Thompson. Mr. Lauer, who has been vice-president of Day & Zimmermann, Inc., for several years, has a country-wide reputation as an industrial engineer. A native of Pennsylvania, in 1893 he entered the employ of the Link-Belt Company, where he advanced to the position of plant superintendent. In 1902 he became associated with Dodge & Day, and with its successor companies, Dodge, Day & Zimmermann and Day & Zimmermann, Inc., has served as general manager, member of firm, secretary, treasurer and vice-president.

During the World War Mr. Lauer was in charge of important construction work at Erie and Philadelphia under government contracts. He is the author of "Engineering in American Industry," in which he traces the development of some of the more important American engineering contributions to the industrial development of the race. He is a director of the Republic Trust Company, L. F. Grammes & Sons Company, Keystone Telephone Company, Welsbach Company, Day & Zimmermann, Inc., and Day & Zimmermann Securities Corporation, and a member of the Council of American Society of Mechanical Engineers.

THOMAS P. CRUMLEY, vice-president and general manager of the Jersey Central Power & Light Company, has been elected president of that organization. HALSEY D. POLHEMUS, assistant to Mr. Crumley, has been named vice-president.

WALTER H. SAMMIS, formerly assistant to C. W. Tippy, general manager of the Consumers Power Company, Jackson, Mich., has assumed new duties in the New York office of the Allied Power & Light Corporation, where he is now assistant to T. A. Kenney, vice-president of that corporation. Mr. Sammis has been assistant to Mr. Tippy since 1925. He first joined the Consumers organization in 1920 and has been affiliated with it since that date except for one year spent in the employ of Charles H. Tenney & Company of Boston.

R. E. Ritchie New President of Arkansas Association

Robert E. Ritchie, who was elected president of the Arkansas Utilities Association at the annual convention held in Hot Springs, Ark., is assistant to Harvey C. Couch, president of the Arkansas Power & Light Company, the Louisiana Power & Light Company, the Mississippi Power & Light Company and the Louisiana & Arkansas Railway Company. Mr. Ritchie has climbed rapidly by his own efforts and at the present time is occupying a special place in the Couch organizations, now serving several hundred cities and towns in the developing industrial and agricultural territories of Arkansas, Louisiana, Mississippi and east Texas. After engaging in railroad work for some years, he joined the Couch forces in 1923, becoming assistant to the vice-president and general manager, J. L. Longino. Later he was made assistant superintendent of the Arkansas Power & Light Company, a position he filled for several years. With the further extension of the Couch electric power companies and the entry of Mr. Couch and some of his associates into the railroad field, bringing together the Louisiana & Arkansas and the Louisiana Railway & Navigation companies, Mr. Ritchie became assistant to the president of all the organizations.

ALEX DOW, president of the Detroit Edison Company, sailed for Europe last week to spend a short sojourn abroad.

JOHN J. O'BRIEN has been elected president of the Philadelphia Company to succeed A. W. Robertson resigned, and F. R. PHILLIPS has been elected a director.

WALTER WHETSTONE, president of the Southern Cities Utilities Company, sailed May 9 for Spain on a business trip in connection with the Spanish properties recently acquired by the Southern Cities Utilities system.

CLEMENT J. STUDEBAKER, JR., has been elected president of the United Power & Light Corporation and A. M. PATTEN has been elected executive vice-president of the same company. Mr. Studebaker is also president of the North American Light & Power Company and the Illinois Power & Light Corporation.

WILLIAM D. L. STARBUCK, since 1925 actively engaged in patent law work with headquarters in New York, has been appointed by President Hoover the member of the Federal Radio Commission representing New York and New England. Following graduation from Columbia University as a mechanical engineer, he practised his profession in New York and in the Middle West until the end of 1917. After he was discharged from military service in 1919 he became a member of the engineering firm of Starbuck & Clapp and subsequently he held executive positions with several manufacturing companies.

JUDD W. SPRAY, vice-president and general sales manager of the Timken Roller Bearing Company, was elected a member of the board of directors at the recent annual meeting of stockholders. A. C. Ernst of Cleveland, Ohio, was also elected to the directorate. Mr. Spray has been with the company for fourteen years in various capacities, having been Detroit sales manager up to 1926, when he was named general sales manager. In 1928 he was made vice-president in charge of sales.

Personnel Changes in Puget Sound Organization

Occasioned in part by the separation of the power business and the Tacoma street and interurban railway business, formerly operated together by the Puget Sound Power & Light Company, Seattle, several changes in the personnel of the district organizations of the company have been necessary. GEORGE NEWELL, formerly manager of the northeastern district, Everett, has become manager of the North Coast Lines, Seattle, and R. T. SULLIVAN, formerly manager of the southwestern district, Tacoma, has been appointed to represent the bondholders in their reorganized subsidiary, the Tacoma Railway & Power Company. Mr. Newell is succeeded in Everett by FRANK WALSH, formerly superintendent of power in that district, who is himself succeeded in that position by E. R. NIGH, who held a similar position in the western district, Bremerton. E. W. CONROY becomes superintendent of light and power at Bremerton, succeeding Mr. Nigh. R. C. SAUNDERS, formerly sales manager of the southwestern district, Tacoma, succeeds Mr. Sullivan as district manager, while FRED H. KERR has been transferred from sales manager at Bremerton to succeed Mr. Saunders.

Other new department heads of the southwestern district, succeeding the members of the old organization who have joined the new transportation company, are: C. H. Hoge, superintendent of light and power; F. H. Anderson, assistant treasurer, and Howard Wright, purchasing agent. Mr. Hoge was formerly superintendent of construction of the central district, Seattle, and is succeeded there by B. R. Shutt. Mr. Anderson was formerly assistant treasurer of the southern district, Chehalis, and is succeeded there by W. J. Pfluge. Former members of the Tacoma organization of the Puget Sound Power & Light Company who have now joined the Tacoma Railway & Power Company include Curtis L. Hill, formerly superintendent of power, and W. E. Wilmot, who was formerly assistant treasurer.

C. V. Sorenson Heads Indiana Association

C. V. Sorenson, who was elected president of the Indiana Electric Light Association at the recent convention held in Gary, as announced in the May 11 issue of the ELECTRICAL WORLD, has been connected with the public utility industry in the Middle West since 1916. From that year until 1923 he served as district manager of the Wisconsin Power & Light Company at Rice Lake, Wis., and in 1924 he was named vice-president of the Attica Electric Company with headquarters in Attica, Ind. After occupying that position for three years he was appointed sales manager of the subsidiary companies of the Central Indiana Power Company of Indianapolis.

Mr. Sorenson brings to his new position as head of the Indiana Electric Light Association a broad background of experience obtained in extensive committee work. At the present time he is a member at large of the rural service committee of the N.E.L.A., a member of the newly created joint sub-committee of the N.E.L.A. studying merchandising methods on rural lines, and he is chairman of the rural electric service committee of the Indiana Electric Light Association.

Obituary

MARTIN MALONEY, industrialist and philanthropist, died May 8 in the Bellevue-Stratford Hotel, Philadelphia, after an illness of more than two weeks. A native of Ireland, Mr. Maloney came to this country at an early age and established residence in Scranton. Subsequently he removed to Philadelphia, where he obtained contracts for lighting the streets of that city, Jersey City, Pittsburgh and Camden. He came into public attention when he obtained the concession for lighting the Centennial Grounds in Fairmount Park in 1876. Later he organized the Penn Globe Gas Light Company and, gradually acquiring gas companies in various states, he with his associates built the nucleus for the United Gas Improvement Company of Philadelphia, organized in 1882. Mr. Maloney also organized the Pennsylvania Heat, Light & Power Company, out of which grew the Philadelphia Electric Company. Mr. Maloney gave liberally of his fortune to charity and he was nationally known for his large benefactions.

Financial and Statistical News

THE apparent utter disregard of money market conditions was a peculiar feature of the week's activity in the securities markets. A heavy selling movement occurred in the face of 7 per cent money early this week, while the market recovered sharply with the call rate at 10, and was fairly buoyant with the rate at 15. This is not so surprising when one considers recent money market conditions and the influence of "outside" funds.

——AFTER REACTING TO THIS BEAR ATTACK, the utilities more or less led the market up in a buoyant recovery. In many instances, such as Electric Investors and North American, new high levels were established in the movement.

——BUYING CONTINUES HEAVY in many of the utility common stock leaders. Transactions were exceptionally heavy this week. The market is apparently coming to appreciate the intrinsic value behind many of these issues even if they are selling at from twenty to twenty-five times last year's earnings. There may be artificial values in the list, but they would seem decidedly exceptional.

American Superpower to Absorb Affiliated Company

The directors of the American Superpower Corporation and of the Utility Shares Corporation voted May 8, at separate meetings, to merge the latter company into the former, subject to the approval of stockholders of both companies. The Utility Shares Corporation is a Delaware company and over 93 per cent of its stock is already owned by the American Superpower Corporation.

The proposed merger agreement provides that each holder of a common share of the Utility Shares Corporation will be entitled to receive one share of new common stock of the American Superpower Corporation as it will exist after the proposed split-up of the present stock at five shares for one. A stockholders' meeting to pass on the merger will be held on June 4, at which time the split-up of the American Superpower stocks will also be acted on.

Spokane Stockholders Approve Capitalization Plan

Stockholders of the Washington Water Power Company at a special meeting held in Spokane, April 25, in lieu of the annual meeting, approved plans for substantially broadening the financial set-up of the company. The proposals approved included increase of the common stock, of which more than 99 per cent is held by the American Power & Light Company of New York, and an exchange of ten shares of the new common for one of the old, a plan for the exchange of new $6 preferred stock for the old $6.50 preferred on a share-for-share basis plus a cash allowance of $8.33 per share, and the issuance of a new $6 no-par value non-voting preferred stock.

Under the amended articles of incorporation the capitalization of the company will be 5,000,000 shares of no-par common stock, 50,000 shares of $6.50 preferred stock of a par value of $100, and 200,000 shares of $6 preferred stock with no par value. Among the changes authorized at the meeting was that of changing the date for the annual meeting from March to the first Monday in June.

United Corporation Assets Total $300,000,000

The listing of securities of the United Corporation of Delaware on the New York Stock Exchange on May 8 revealed the amount of that company's holdings in public utility systems, its earnings and other valuable and interesting data. The listings authorized included 5,665,910 common and 1,756,335 preference shares. The United Corporation, organized only four months ago by J. P. Morgan & Company, Drexel & Company and Bonbright & Company, who jointly control it, now has assets with a book value exceeding $300,000,000. The company's list of holdings, including 214,056 shares of United Gas Improvement acquired since April 23, are as follows:

Stock	Holdings (Shares)
Mohawk-Hudson Power, common	350,957
Mohawk-Hudson, 2nd preferred	62,370
Mohawk-Hudson, option warrants	124,740
Public Service of New Jersey, common	959,682
United Gas Improvement, capital stock	739,526
Allied Power & Light, common	340,000
Columbia Gas & Electric, common	154,000

The company's application was for the listing of 5,184,284 common and 1,435,251 cumulative preference, $3 dividend stock, both of no par value, issued and outstanding on April 23, 1929, and 481,626 common and 321,084 preference shares reserved against exchanges of United Gas Improvement stock which have been issued since that date. At present there are 5,665,910 common and 1,756,335 preference shares issued out of an authorized issue of 10,000,000 common and 2,000,000 preference shares. There are 1,000,000 authorized first preferred shares, of which none have been issued. Of the common shares authorized, $4,000,000 have been reserved against option warrants entitling the holders to acquire such stock at $27.50 a share, so that an issuable balance of only 334,090 common and 243,665 preference shares remains.

In the period from January 7 to April 23 the company earned $2,163,282, including $1,010,046 dividends received, and more than $1,000,000 from profit on securities sold and underwriting commission. Net income after federal tax reserves and expenses was $1,996,797, while a preference dividend of $754,751 was paid on April 1.

Institutional Investors in Associated Gas & Electric

The growing tendency of corporations and institutions to invest in equities of seasoned public utility companies is shown by the accompanying figures made public by Harris Forbes & Company in connection with the holdings of the Associated Gas & Electric system. For the six-month period from October 4, 1928, to March 30, 1929, the total number of companies and institutions holding Associated Gas & Electric securities has risen 2½ times from 192 to 704.

	March 30, 1929	October 4, 1928
Corporations	164	35
Fraternal and charitable organizations	129	49
Schools and colleges	11	6
Banks and trust companies		
(A) trusts, estates, etc., held by banks	11	..
(B) Investment for their own account	195	..
(C) Those who have invested trustee funds	110	..
Total	316	70
Insurance companies	19	11
Investment trust	65	21
	704	122

New Capital Issues Offered

Among the new capital issues recently offered to the investing public was a nine-million-dollar offering of first mortgage and refunding gold bonds, series A, of the Gulf States Utilities Company at 94 and accrued interest to yield 5.42 per cent. All of the common stock of the Gulf States Utilities, which provides electric service to 94 communities in Texas and Louisiana, is owned by the Eastern Texas Electric Company, a subsidiary of the Engineers Public Service Company. Proceeds will be used to finance the recent purchase of new properties and to reduce floating debt incurred for extensions.

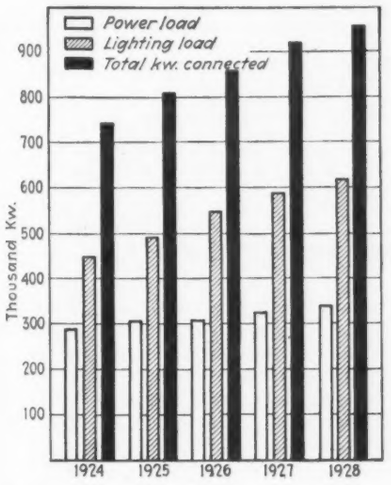
One foreign issue appeared among the

new offerings. The British Power & Light Corporation issued 1,600,000 shares at £1 per share in London. Subscriptions for these shares were received by Clark, Dodge & Company in New York. Proceeds from the sale will be used to acquire the shares of the subsidiary companies and with the additional 100,000 shares expected to be issued in 1930 will provide working capital adequate for contemplated requirements up to 1932. The British Power & Light Corporation was incorporated on May 7, 1929, for the purpose of operating electrical generating and distributing undertakings. It will operate in North Wales and in Central and South England.

Curtis Lighting, Inc., issued 46,500 shares of common stock at $22 per share. This company has been engaged for 34 years in the development, engineering, designing and manufacturing of scientific electric lighting equipment.

Northern States Power Reports Development in All Branches

IN THE annual report covering operations for the year 1928 the Northern States Power Company of Minnesota published the results of intensive commercial development and further improvement in operating efficiency. Gross earnings increased 5.16 per cent, while net earnings gained 6.66 per cent. Gross earnings amounted to $31,339,721 in 1928, as compared with $29,803,693 in 1927, and net earnings totaled $16,097,380, against $15,092,232 during the preceding year. To this total gross of $31,339,721 the electric department contributed $25,915,677, or 82.69 per cent, and to the total net of $16,097,380 the electric department contributed $14,738,065, or 91.56 per cent. The ratio of operating expenses to gross earnings was 48.64 per cent for 1928, compared



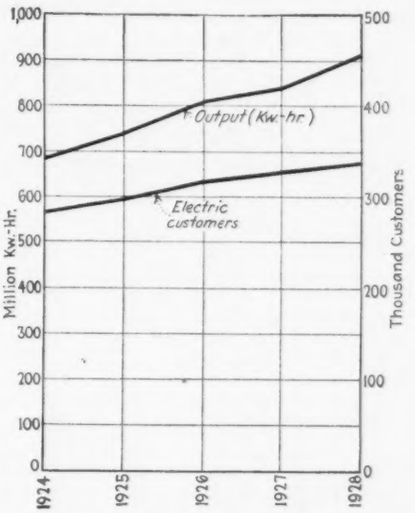
Connected Load of Northern States Power Since 1924

with 49.36 per cent for 1927 and with 50.04 per cent in 1926.

The financial operations of the company are interesting to note. During 1928 the company retired $2,236,740 face value of funded debt, which included $1,686,200 face value convertible 6½ per cent gold notes, due 1933, converted into class A common stock, increasing the amount of that class of stock outstanding by a like amount. During the year $9,304,900 par value 6 per cent cumulative preferred stock was sold from the treasury and the company reacquired $291,400 face value funded debt and $5,193,700 par value 7 per cent preferred stock. As a result of the rights given to common-stock holders as of January 3, 1928, the company issued and sold $5,665,300 par value class A common stock and 125,000 shares class B common stock. In December, 1928, holders of the class A common stock were offered the privilege of subscribing to additional class A stock at $100 a share to the extent of one-sixth of their holdings as of January 7, 1929. At the same time holders of the class B common stock were offered the right to subscribe to additional class B shares to the same extent. Subscription rights on both classes of stock expired February 7, 1929. For this purpose the board of directors authorized the issuance of additional class A and class B common stocks to the extent of one-sixth of the aggregate amounts outstanding as of January 7, 1929. As of December 31, 1928, the company had a total of approximately 65,000 preferred shareholders, an increase of approximately 2,000 shareholders for the year. Most of the shareholders are customers.

Operating statistics reveal the true story of the Northern States Power Company's growth. Excluding the customers served indirectly through wholesale contracts, service was furnished to a total of 450,579 customers of all classes at December 31, 1928, a gain of 13,805 customers, or 3.16 per cent, over 1927. Electric connected load increased from 918,678 kw. to 962,312 kw., or 4.75 per cent over 1927. Electric energy output increased 8.27 per cent to a total of 908,760,906 kw.-hr., as compared with 839,375,628 kw.-hr. during the year 1927. Electricity was being served to 3,000 farms at the close of 1928. Construction expenditures for additions and improvements to properties during 1928 amounted to $6,788,285. The Chippewa Falls hydro-electric plant, with a capacity of 21,600 kw., was completed and was in operation in June, 1928. A 110,000-volt transmission line was completed connecting this plant with the Wissota plant, and with the existing 110,000-volt transmission system. Additional electric generating capacity was installed at Grand Forks and Minot, N. D., in order to accommodate the rapidly growing business in these districts. In 1928 the expenditures on extensions and improvements to the company's distribution system represented a large portion of the construction budget. The estimated capital requirements for 1929 as shown by the construction budget totals $7,546,000. The greater part of the expenditure will be for extensions and improvements to the distribution systems in order to provide for additional business.

In closing the report John J. O'Brien, president of the Northern States Power Company, said: "The territory in which your company operates is showing signs of increased prosperity. The results of last year's harvesting of the crops were favorable and the outlook for agriculture is better than it has been for many years past. This, of course, reacts favorably

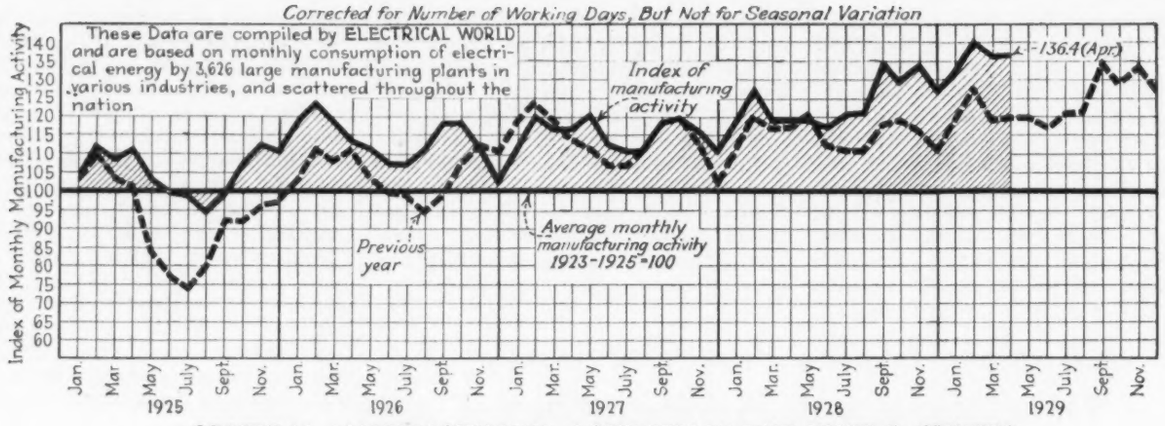


Electric Customers and Output Covering Five-Year Period

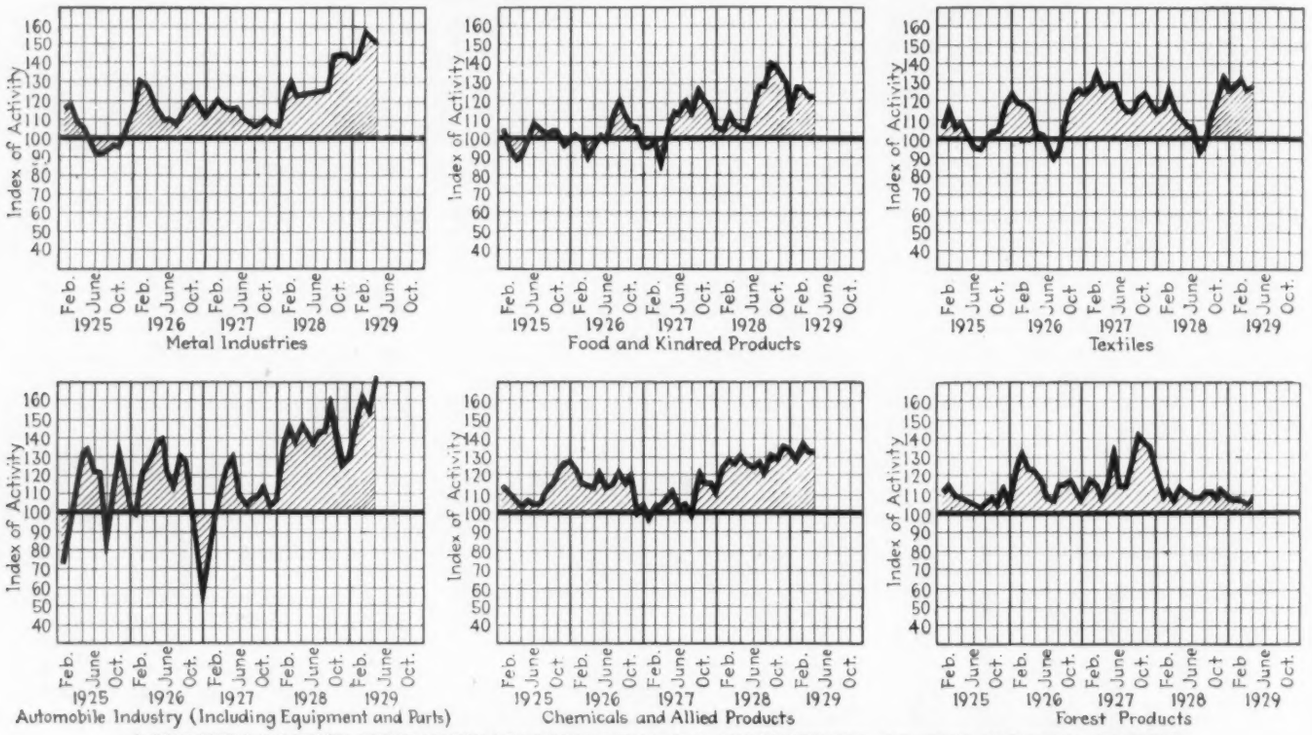
on the business development of the cities and towns served by your company. The relations of your company with the communities served are excellent. We look forward to a continuance of the sound business conditions which will reflect favorably on the earnings of your company."

Seaboard Investment Group Formed by Parker Interests

To the long list of investment trusts has been added the Seaboard Utilities Shares Corporation, a Massachusetts incorporation formed by interests identified with C. D. Parker & Company, Inc., Boston. This trust has been formed to acquire securities of electric power, gas and holding companies in the United States and more especially in the densely developed regions of the East. It expects to profit by more than the usual growth in net earnings and resultant share appreciation in light and power utilities through the development of diversified business, hydro-electric resources and interconnection, especially along the Atlantic seaboard. The portfolio already lists common shares in 42 companies. The corporation has but one class of shares, 500,000 common having been offered at $11 per share. C. D. Parker, Boston, is president and Bowen Tufts, Boston, vice-president.


Corrected for Number of Working Days, But Not for Seasonal Variation
These Data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,626 large manufacturing plants in various industries, and scattered throughout the nation
Index of manufacturing activity
136.4 (Apr.)
Previous year
Average monthly manufacturing activity 1923-1925=100
Index of Monthly Manufacturing Activity
1925
1926
1927
1928
1929

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES



ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

Record Productive Operations During April

A NEW record for monthly rate of activity was hung up during April by the manufacturing plants of the country, according to data on electrical energy consumption received by ELECTRICAL WORLD from over 3,600 manufacturing plants scattered throughout the country. While the average daily rate of activity during April was slightly under that of February, yet when corrections are made for seasonal variation it is found that the rate of April operations was 3.3 per cent over February and 1.1 per cent over the previous high seasonally corrected figure recorded last September. In other words, the decrease in the rate of monthly operations which is normally to be expected as the spring season advances has been less during the current spring than the average decrease during corresponding periods in recent years.

The rate of April manufacturing activity was on a plane 0.5 per cent over March and 14.3 per cent over April last year.

The automobile manufacturing industry, including the production of replacement parts and accessories, set a new high rate of average daily activity for that industry. The April rate of activity in these plants was 10.4 per cent over that of March, 14.7 per cent over April of last year and 5.6 per cent over the previous high rate of operations set during February of this year. Record operations were fairly general throughout the automobile manufacturing industry. Other outstanding gains over April last year were reported in the rubber products industry with 28 per cent, iron and steel industry 22.2 per cent, ferrous and non-ferrous metal-working industry 21.8 per cent, textiles industry 16.7 per cent, paper and pulp industry 12.9 per cent, and the stone, clay and glass industrial group with a gain of 8.6 per cent. The leather products and lumber products groups were the only two reporting a current rate of operations under that of April last year.

Every section of the country witnessed a rate of operations during April materially above that of April, 1928. The Middle Atlantic States lead all sections of the country with a gain over last year of 14.3 per cent, followed by the North Central States with 13.6 per cent, the Western States with 13.4 per cent, New England with 10.2 per cent and the Southern States with a gain over April of last year of 9.7 per cent.

MONTANA POWER STOCK SPLIT-UP APPROVED.—Stockholders of the Montant Power Company on April 29 approved a proposal to split up the common stock on a five-for-one basis and authorized the issuance of 152,154 shares of no-par value preferred stock.

Business News and Market Conditions

Capacity of Prime Movers Up Almost 10 per Cent

Announcement is made by the Department of Commerce that according to data collected at the biennial Census of Manufactures taken in 1928 the total rated capacity of prime movers, including engines, turbines, waterwheels and electric motors driven by purchased current, in use and available for use in manufacturing establishments in 1927 amounted to 39,040,563 hp., an increase of 9.2 per cent over the total in 1925, which was the last preceding census year. The largest item in the 1927 total is 19,144,995 hp., which is the rating of electric motors driven by purchased current. This figure represents an increase of 20.7 per cent over the corresponding items for 1925. The combined horsepower of steam engines and steam turbines was approximately the same for 1925 and 1927, a decrease of about 1,300,000 for steam engines being counterbalanced by similar increase for steam turbines. Slight decreases are shown in the power of internal combustion engines and water wheels and turbines. The use of electric power generated in the plants increased rapidly.

Metal Markets Continue to Mark Time

Little change has been evident during the last week, either in volume of sales or price, in the principal non-ferrous metal markets. The situation continues exceedingly quiet, with a pronounced trend toward hand-to-mouth buying as stocks in consumers' hands continue to dwindle.

NEW YORK METAL MARKET PRICES

	May 8, 1929 Cents per Pound	May 15, 1929 Cents per Pound
Copper, electrolytic	18	18
Lead, Am. S & R. price	7.00	7.00
Antimony	9.00	9.00
Nickel, ingot	35	35
Zinc, spot	6.975	6.975
Tin, Straits	44.375	44.125
Aluminum, 99 per cent.	24.30	24.30

Base copper wire price May 15, 1929, 19½ cents.

British Lamp Cuts End Use of Clear Bulbs

The Electric Lamp Manufacturers' Association, which controls the manufacture and sale of incandescent electric lamps in Britain, announces an imminent reduction in the prices of certain types of lamps. The reduction is the first step in a process which no doubt will lead to the ultimate suppression, except for special purposes, of lamps in clear glass bulbs, for in the case of several types of lamps commonly used the reduction brings the cost of those in which the bulb is internally frosted or "pearled" actually below that of similar lamps in clear glass bulbs. The 100-watt pearl lamp, for example, in the standard voltages, will cost 6d. less (12 cents) than the same size in transparent glass bulb. In order to assist in the general simplification and standardization of the many pressures at which current is available from the main in Britain, lamps which conform to the standard of 230 volts will cost 1d. (2 cents) less than those made for other pressures.

Sales of Manufactured Goods to Europe Could Be Expanded Radically*

By Dr. Julius Klein
Assistant Secretary of Commerce

A WELL-INFORMED observer of European conditions recently declared that the biggest single international problem now confronting the world, the situation most fraught with grave significance for the future, is the economic rivalry between Europe and the United States—the struggle for markets, communication facilities, preferred steamship routes, raw material controls and financial footholds.

* * * *

As for the general recovery of European foreign trade, the figures for 1928 continue to show outstanding progress by France and Italy, both of which have passed the 1913 volume figures and have registered an increase in the value of their exports of 51.6 per cent and 57.7 per cent respectively. The United Kingdom is still behind her 1913 volume, having registered a value increase in 1928 over the pre-war year of only 31.4 per cent. Germany, if we exclude reparation exports, showed an increase last year of 12.8 per cent over the last full pre-war year, which puts her considerably below her 1913 volume of overseas sales.

With reference to the commercial relations between the United States and Europe, a number of rather significant changes were recorded during 1928. In the first place, the European share of our total overseas sales has declined steadily, whereas during the first decade of this century Europe took about 70 per cent of our total exports; her takings last year were but a little over 46 per cent.

* * * *

Although the largest single items in our exports to Europe are still made up of crude materials, notably cotton and copper, and petroleum, nevertheless finished manufactures have been going forward so rapidly that they now have taken second place in the four major classes of merchandise, supplanting foodstuffs, which had long been ranking second.

It is a striking commentary upon the improvement of living standards in Europe and the requirements of her factories for machinery and industrial equipment that our exports of finished manufactures to the Old World are now more than four times the value of those in 1913, whereas exports of crude materials and foodstuffs recorded in each case a less-than-doubling of their totals.

* * * *

It is highly advisable, therefore, for any American manufacturer contemplating export to canvass the prospects for markets in Europe on the very doorsteps of his supposed competitors. Improved buying power and better conditions of credit have strengthened the potentiality of European demand and have made for distinctly better markets for American quality products.

* * * *

The universal admiration of our post-war industrial technique and the almost blind acceptance of American "rationalization" principles (standardization, simplification, etc.) by Old World executives have combined to create unusual oportunities for American manufacturing industries.

**From an address before the McGraw-Hill staff, May 13, 1929.*

Market Conditions

ELECTRICAL equipment orders both from central stations and from industrial concerns are lower this week throughout the Eastern district.

——WHILE CURRENT ORDERS THROUGHOUT THE SOUTHEAST are small on the average, the volume this year to date is well over that of the same period last year. Some substantial orders also are pending.

——IN THE NEW ENGLAND AREA POWER EQUIPMENT SALES have shown a substantial advance.

——THE VOLUME OF BUSINESS CONTINUES SATISFCTORY on the Pacific Coast. Construction is proceeding rapidly, especially in the northern sections.

Sales Volume Declines in Eastern District

Orders for electrical equipment both from central stations and industrial interests in the New York district are declining. While the condition is considered as temporary, inquiries at the moment are exhibiting similar tendencies and are decidedly spotty. At Philadelphia, Pittsburgh and other points in the Eastern district, however, sales continue to hold up well and sizable transactions are being recorded. Current bookings include several motor-generator sets for iron and steel mill service, with other orders in sight from this quarter. Motor account with textile mills gives early promise, and although inquiries are scattered, sizable gross business is anticipated. A producer of motors reports an order for fractional-horsepower units from a manufacturer of washing machines in northern New York totaling $150,000 and further business for small motor account has good prospects, particularly in connection with refrigerators.

Central-station business is rather confined to substation and minor line equipment. Switching equipment is in fair demand, although individual orders are small. Metropolitan account in oil circuit breakers is of reduced order, but several utility companies in New Jersey and Pennsylvania, as well as at Southern points, have inquiries out for apparatus of this kind and early commitments are expected. A New York manufacturer has secured a contract for a turbine installation for a power station addition in Wisconsin. A maker of Diesel engines in Pennsylvania has closed an order for eleven units for industrial and marine service and reports business as excellent, with an accumulation of commitments totaling in excess of $1,000,000. A manufacturer of condensers at New York has taken a contract for a large installation on the Pacific Coast, said to aggregate about $300,000. Municipal power station account is moving to higher levels. A manufacturer of prime movers and auxiliary equipment has secured awards from a number of Middle West municipalities in Nebraska, Minnesota and other states. Inquiries from this source are the highest in several weeks and sizable transactions are looked for. A maker of electric elevators states that business shows improvement and an order has been received for an installation in an office building at Philadelphia, to cost $125,000, and for a quantity of control apparatus, with motors and accessories for a New York building, costing $30,000. Construction projects are as follows:

The Meurer Steel Barrel Company, Long Island City, N. Y., will build a plant at Newark, N. J., to cost $150,000. The Board of Education, New York, plans a vocational school at St. George, S. I., to cost $1,000,000. The Bureau of Supplies and Accounts, Navy Department, Washington, will receive bids until May 28 for 26 electric air heaters (Schedule 970) for the Brooklyn Navy Yard. The American & Foreign Power Company, New York, plans a hydro-electric power plant near Mezquital, Mexico, to cost $4,000,000. The Trico Products Corporation, Buffalo, N. Y., will build an addition to its automobile equipment plant to cost $100,000. The Cerro de Pasco Copper Corporation, New York, plans a hydro-electric power plant on the Montaro River, near Oroya, Peru, to cost $6,000,000 and will make extensions in its zinc and copper mills at that place to cost $5,000,000. The Ford Motor Car Company, Detroit, plans an automobile assembling plant at Edgewater, N. J., to cost $5,000,000. The American Platinum Works, Newark, N. J., will build an addition to cost $100,000. Lambertville, N. J., will make extensions in its street-lighting system. The Quartermaster, Picatinny Arsenal, Dover, N. J., will receive bids until June 4 for a group of twelve buildings, to cost $300,000. The supervising architect, Treasury Department, Washington, will receive bids until May 23 for a motor-generator set for the Mint at Philadelphia. The Federal Container Company, Philadelphia, will build an addition to cost $90,000. The Union Battery Company, Chicago, contemplates a plant at Philadelphia, to cost $300,000. The Vacuum Oil Company, New York, plans a storage and distributing plant at Philadelphia, to cost $200,000. The Pennsylvania Railroad Company, Philadelphia, will build a storage and distributing plant to cost $2,500,000 and a power substation to cost $150,000. The American Sheet & Tin Plate Company, Pittsburgh, contemplates a mill at Sharon, Pa., to cost $500,000. The Baltimore & Ohio Railroad Company, Baltimore, Md., will make extensions in its engine terminal and shops at New Castle, Pa., to cost $150,000. The Chief of Engineers, United States Army, Washington, will receive bids until May 29 for ten 5-kw. generating sets (Circular 14). The General Purchasing Officer, Panama Canal, Washington, will receive bids until May 24 for two transformers and other equipment (Schedule 1962).

Power Equipment Sales Active in New England

Power equipment for control and regulators is in good demand in the New England district. An order for plant equipment amounting to $11,000 was closed for eastern Massachusetts consisting of a 200-kw. turbo-generator, a 75-hp. rotary converter and accessories. Inquiries for small power generators are more active and small motor sales are brisk, the orders amounting to about $55,000. A manufacturer reported sales of small motors and industrial control apparatus of about $18,000. An Eastern mill recently placed an order for a 200-hp. motor and a number of 50-hp. motors for group drive are noted among recent orders. Central-station equipment is moving steadily and an order amounting to about $2,500, including line hardware and outside equipment, was received. Insulator sales are steady and electric furnace orders are being received. Arc welding equipment sales are gaining and during the past week a 200-amp. arc welding unit was sold. Construction projects are as follows:

The Boston & Albany Railroad Company, Boston, will make extensions in the engine house and shops at Allston, Mass., to cost $100,000. The Boston, Worcester & New York Street Railway Company, Worcester, Mass., plans extensions in the power plant at Framingham, Mass., to cost $75,000. The Arbecka Webbing Company, Pawtucket, R. I., will build an addition to its textile mill to cost $65,000. The L. F. Dettenborn Woodworking Company, Hartford, Conn., will build an addition to cost $80,000. The Naugatuck Chemical Company, Waterbury, Conn., plans an addition to cost $90,000.

Considerable Business Pending in Southeast

The reaction from the large volume of orders recently placed in anticipation of price changes has not yet run its course in the Southeast and such orders as are coming through are small in size. However, the total sales for the year to date show a satisfactory increase over the same period of last year. Considerable business is still pending and the next few weeks should witness an increased activity in the electrical field. One large power company's transformer orders aggregated $11,400, while its creosoted pine pole business amounted to $8,400. Some other central-station orders were for switching equipment amounting to $4,400 and line materials amounting to $3,800. A rayon plant in Georgia ordered $2,000 worth of inside wiring materials, while a contractor in the same state ordered conduit amounting to $2,500 for a residential development project on the coast. Two municipal systems placed orders for a carload of creosoted pine poles each. The

Georgia Power Company has purchased the municipal distribution system in Newbern, Ala., and will construct 3 miles of transmission line to tie this town in its system. Construction projects are as follows:

The Hy-Grade Manganese Company, Woodstock, Va., plans extensions in its plant to cost $150,000. The Ducktown Chemical & Iron Company, Ducktown, Tenn., will make extensions in its plant at Isabella, Tenn., to cost $500,000. The Roberts Candy Company, Nashville, Tenn., plans an addition to cost $75,000. The Ingalls Iron Works Company, Birmingham, Ala., plans an addition to cost $100,000. The Coca Cola Bottling Company, Gadsden, Ala., plans a plant to cost $80,000. The Gulf States Steel Company, Gadsden, Ala., will make extensions in its mill to cost $3,000,000. The Choctaw Clay Corporation, New Orleans, La., plans a clay mining and refining plant at Needham, Ala., to cost $300,000. The Nashville, Chattanooga & St. Louis Railway Company Nashville, Tenn., plans a multi-story cold storage plant at Atlanta, Ga., to cost $350,000. The Southern Air Transport Company, Fort Worth, Tex., plans shops, hangars, and other airport buildings at Atlanta, Ga., to cost $100,000.

Slight Acceleration of Sales in Middle West

A slight acceleration of business is noticeable in the Middle West section. Most lines of industry are proceeding with confidence, preparing for summer activity in trade. Recent reports of building activity in the suburban district surrounding Chicago show a turn for the better with an indicated gain of 33⅓ per cent over the month of April last year. The utility companies are continuing their conservative policies with regard to extended purchasing, although plans formulated for expansion this year are being carried out at this time. Interesting orders that have been placed include one for 50 25-kva., 50 37½-kva., 65 75-kva., 37 150-kva., 20 200-kva. distribution transformers, 4,000 5-amp. watt-hour meters, 625 Thompson meters of 5 to 50 amp. capacity, "Mazda" lamps valued at $150,000 and several construction orders aggregating $100,000. Jobbers' sales are normal. Construction projects are as follows:

The Badger Zinc Company, Platteville, Wis., plans a milling plant at Linden, Wis., to cost $60,000. S. C. Johnson & Son, Racine, Wis., will build an addition to its paint and varnish plant to cost $85,000. The Northern Indiana Public Service Company, Hammond, Ind., plans a power plant at Michigan City, to cost $1,000,000. The Goodyear Tire & Rubber ompany, Akron, Ohio, will make additions in its mill at St. Hyacinthe, Que., to cost $1,500,000. Miamisburg, Ohio, plans extensions in its municipal electric light and power plant to cost $75,000. The Bessemer Limestone & Cement Company, Youngstown, Ohio, plans a storage and distributing plant at Toledo, Ohio, to cost $100,000. The Oakland Motor Car Company, Pontiac, Mich., will build an addition to cost $130,000. Sall Brothers, Rockford, Ill., will build an addition to its automobile equipment manufacturing plant to cost $100,000. The Pillsbury Flour Mills Company, Minneapolis, Minn., contemplates a mill at Springfield, Ill., to cost $750,000. Benson, Minn., will make extensions in its municipal electric light and power plant to cost $70,000. Minneapolis, Minn., plans an ornamental lighting system to cost $35,000. David City, Neb., plans extensions in its municipal electric light and power plant to cost $28,000. Hastings, Neb., contemplates extensions in its municipal power plant to cost $95,000. The Iowa Power & Light Company, Davenport, Iowa, plans extensions in transmission lines to Leighton, Iowa, and vicinity. The Rath Packing Company, Waterloo, Iowa, will build an addition to its meat-packing plant to cost $225,000.

Many Power Company Orders Placed on Pacific Coast

Power company and electrical machinery orders, particularly for transformers, continue to feature business on the Pacific Coast. Machinery business includes a $500,000 compressor outfit for the Kettleman oil fields, a 300-kw. engine generator set for the Los Angeles general hospital, six carloads of 25-ft. treated poles and 2,000 ft. of 1,000,000-circ.mil, 20,000-volt varnished cambric cable for the city of Los Angeles, a small power plant for a Reno, Nev., hospital and a power distributing system for a hospital at Palo Alto, Calif. Machinery orders include a harbor dredging outfit comprising a 1,200-hp. and a 400-hp. General Electric motor sold to a bay shipbuilding concern, valued at $13,000, a trunk type Westinghouse switchboard valued at $45,000, assorted motors valued at $20,000 for the Salt River irrigation district in Arizona, and a $20,000 Westinghouse motor and exciter equipment for the Los Angeles water works. Transformer orders include four of size 2,000-kva., valued at $25,000 for the California Oregon Power Company, a lot of subway type for Los Angeles valued at $15,000 and an assortment of distributing transformers valued at $55,000 for a southern California system. In addition to these special orders small pumping size transformers are in heavy demand, one manufacturer reporting sales for nearly 500 during the past week.

With the foundation work on the second unit of the five-million-dollar Shuffleton steam plant well under way the Puget Sound Power & Light Company placed an order with the General Electric Company for a 40,000-kw. turbine costing between $400,000 and $500,000. On May 31 the Seattle board of public works will open bids for construction of an addition to the Albion Place substation in Seattle. Bremerton, Wash., is considering a $750,000 municipal lighting system. The city of Centralia, Wash., awarded a contract for a 9½-mile ditch, and initial step in the construction of the million-dollar hydroelectric plant on the Nisqually River. The Northwestern Electric Company will spend $25,000 in line transmission work between Camas and Stevenson, Wash., and the Pacific Power & Light Company about $75,000 for a line from the Powderdale plant to Odell, Ore., where a 1,500-kw. station will be installed. The motor sales reported are a 2,200-volt, three-phase, 60-cycle machine for a water system in southwest Washington, one 150-hp. and one 75-hp. and miscellaneous smaller machines for a mill and woodworking plant in eastern Washington, one 300-hp. machine for a lumber mill in the Grays Harbor district, about $1,500 worth of crane motors for an Aberdeen, Wash., sawmill and about 50 small motors for storage plants, dealers and orchards in eastern Washington. The city of Tacoma, Wash., is taking bids for lead-covered cable. Construction projects are as follows:

The Imperial Valley Milling Company, Holtville, Calif., plans an agricultural milling plant at El Centro, Calif., to cost $100,000. The Detrick-Joslyn Company, Los Angeles, will build a mechanical equipment manufacturing plant to cost $100,000. The Modesto Irrigation District, Modesto, Calif., will receive bids until May 27 for Diesel engine drive electric generators, compressor set, pumps and other power station equipment. The Consolidated Paper Box Company, San Francisco, will build an addition to cost $100,000. The Signal Officer, Ninth Corps Area, Presidio, San Francisco, will receive bids until May 25 for construction of an underground and aerial system for telephone service at the March Field (Circular 3). The Port Stockton Cement Company, Stockton, Calif., plans a cement mill to cost $1,500,000. The California Oregon Power Company, Medford, Ore., plans a transmission line to the Blue Ledge mining district, near Yreka, Calif., to cost $125,000. The Klamath Milk Products Association, Klamath Falls, Ore., plans a plant to cost $100,000. The Pacific Coast Terminals, Inc., Tacoma, Wash., plans a cold storage and refrigerating plant to cost $200,000. The Liquid Carbonic Company, Chicago, will build a plant at Denver, Colo., to cost $80,000. Casa Grande, Ariz., plans an ornamental lighting system.

Weather Hinders Business in St. Louis District

Labor conditions have tended to cause a shutdown of a large part of the building construction work in the St. Louis district and the continued rainy weather has held up nearly all of the outside work. Several large-sized power house projects, including turbines, generating apparatus and switching equipment, are being figured, but the only job worthy of mention reported was for a lot of about 25 auxiliary motors for gas pumping stations to cost $7,000. Reports from jobbers indicate that some lines are keeping up to normal and others are not so good. Construction projects are as follows:

Galt, Mo., is considering a municipal electric lighting plant. Lee's Summit, Mo., plans a municipal electric light and power plant to cost $100,000. The Curtiss-Robertson Airplane Manufacturing Company, St. Louis, plans an addition to cost $300,000. The Arkansas Missouri Power Company, Blytheville, Ark., plans an ornamental lighting system at Mammoth Springs, Ark. The West Texas Utilities Company, Abilene, Tex., plans a 33,000-volt transmission line from Miles to Bronte, Tex., and vicinity. The Baton Rouge Electric Company, Baton Rouge, La., plans a transmission line at Rosedale, La., and vicinity.

Activities of the Trade

Samson Cutlery Company Buys Russell Electric Company

The outright purchase of the domestic electric appliance patents and the business of the Russell Electric Company, Chicago, by the Samson Cutlery Company, Rochester, N. Y., has been announced by A. O. Samuels, president of the latter company. The various departments of the Russell company plant will be removed to Rochester, where a new factory, comprising 100,000 sq.ft. of floor space, will be erected. The Samson Cutlery company manufactures domestic electric appliances in Rochester and a full line of cutlery at a factory in Nunda, N. Y.

International Combustion 1928 Net Up 63 per Cent

The report of the International Combustion Engineering Corporation and its subsidiaries for 1928 shows a consolidated net profit of $3,276,299 after interest, depreciation, federal taxes, etc., equivalent, after dividend requirements on $7 no-par preferred stock, to $3.18 a share earned on 908,263 average number of no-par common shares outstanding during the year. This compares with $2,008,264, or $2.62 a share, on 735,751 average number of common shares outstanding during 1927. The net in 1928 was 63.8 per cent above that of 1927.

Announcement is made that the company is offering common and preferred stockholders of record April 26 the right to subscribe to 50,000 shares of 7 per cent convertible preferred stock at $100 a share on the basis of one new preferred share for every twenty shares of common or preferred stock held.

George E. Learned, president, stated that business in the sale of boilers, stokers and general combustion equipment was showing an increase this year to date of 50 per cent over the corresponding period of 1928.

Frigidaire Month Behind in Filling Its Orders

The plants of the Frigidaire Corporation, Dayton, Ohio, are operating at 20 per cent above their maximum rated capacity and are nearly a month behind in orders as a result of the largest increase in unit retail sales the corporation has ever experienced, according to a statement issued by E. G. Biechler, president and general manager. A total of 1,501 carloads of finished products were shipped in April. As compared with April, 1928, unit shipments last month showed an increase of 129 per cent in household electric refrigerators, 85 per cent in compressors and 88 per cent in cooling coils for both household and commercial use. The Frigidaire cold control recently introduced and the lower-priced models have stimulated sales and May indications point to another record-breaking month.

Kelvinator Gross Revenue Up 27 per Cent

The Kelvinator Corporation, Detroit, reports for the quarter ended March 31 a net profit of $273,250 after depreciation, interest, etc., equivalent to 23 cents a share earned on 1,167,800 no-par shares of capital stock. This compares with a net loss of $413,396 in the preceding quarter and a net profit of $3,790 in the March quarter of 1928.

	1929	1928
Gross	$1,495,781	$1,177,343
Operating expenses	1,039,505	959,614
Operating profit	$456,286	$217,729
Depreciation, interest, etc.	183,036	213,939
Net profit	$273,250	$3,790

The statement for the quarter ended March 31 compares as shown in the accompanying table.

THE ALLEN-BRADLEY COMPANY, Milwaukee, manufacturer of electric control apparatus, announces the establishment of a district office in Atlanta, Ga., with headquarters at 101 Marietta Street. H. Douglas Stier and G. G. Moore will be in charge. The company also announces that John McC. Price has been appointed district manager in charge of its Chicago office, located at 500 North Dearborn Street. Mr. Price was formerly district manager for the Industrial Controller Company in the same territory.

Rice Award Goes to Mine Safety Appliances

Cecil G. Rice trophy awarded annually for best safety record

American Brown Boveri Forms New Subsidiary

The American Brown Boveri Electric Corporation has organized a new subsidiary to be known as the American Brown Boveri Company, Inc., and will handle all of the electrical and mechanical operations exclusive of shipbuilding. The new company is licensed under the designs, patents and processes of Brown Boveri & Company, Ltd., of Switzerland. It owns the entire capital stock of the Condit Electrical Manufacturing Corporation, which company will continue to manufacture and sell its product, electrical control and protective equipment, through its own organization. The officers of the new company are: George A. Burnham, president; Maurice L. Sindeband, vice-president; Joseph T. Graham, secretary and treasurer, and William S. Edsall, general sales manager.

THE CLAUDE NEON LIGHTS, INC., 50 East 42d Street, New York City, announces the removal of its executive offices to 41 East 42d Street.

SCHWEITZER & CONRAD, INC., 4421 Ravenswood Avenue, Chicago, manufacturer of high-voltage protective and switching equipment, announces the appointment of the George H. Wahn Company as its New England correspondent.

THE PAGE STEEL & WIRE COMPANY, Bridgeport, Conn., announces the removal of its New York City offices from the Grand Central Terminal Building to new quarters in the New York Central Building at 230 Park Avenue.

THE TRICO FUSE MANUFACTURING COMPANY, Milwaukee, announces the removal of its New York division sales office to better and larger quarters at 41 Park Row, New York City.

THE FULLER LEHIGH COMPANY, Fullerton, Pa., manufacturer of pulverizing equipment, etc., announces the removal of its New York City office from 50 Church Street to 85 Liberty Street.

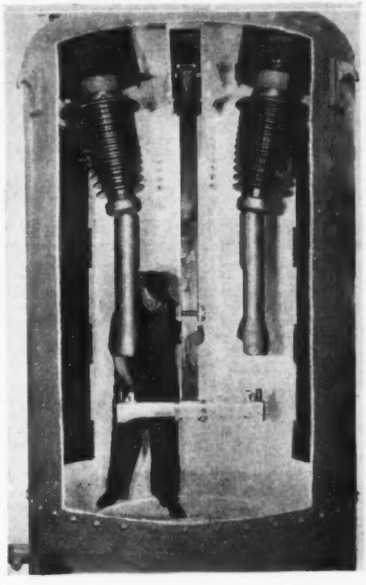
THE GENERAL REFRACTORIES COMPANY, 104 South Sixteenth Street, Philadelphia, has appointed Woodward & MacMillan, Edificio Metropolitana, Havana, Cuba, as its sales agent for Cuba, Guatemala, British Honduras, Honduras, Salvador, Nicaragua, Costa Rica, Panama, Trinidad Island and Jamaica.

THE WESTERN ELECTRIC COMPANY'S sales for the month of March were the largest in the history of the organization, totaling $34,188,000. The sales for the first three months of 1929 were $86,798,000, which exceeds sales for same period last year by $25,505,000.

New Equipment Available

New Development Eliminates Lift Rod Problem

The development of wood base "micarta" by the research and design engineers of the Westinghouse Electric & Manufacturing Company is said to eliminate the lift rod problem which has been a prolific source of trouble on breakers of all types. According to the



manufacturer, the new development has been characterized by many prominent engineers as the greatest single improvement in the mechanical design of high-voltage oil circuit breakers.

For the lower voltage breakers maple, hickory and ash have been used with varying success, but owing to the difficulty of getting the proper material trouble has developed even with the use of the most satisfactory natural material available. On higher voltage breakers, owing to the high dielectric requirements, it was necessary to use a material of higher dielectric strength than wood. This resulted in the development of a paper base micarta which had good mechanical and dielectric strength.

Doubling the size of the rod of paper base micarta did not double the strength, while the possibility of defects was more than doubled. A synthetic material whose manufacturing processes could be rigidly controlled was desirable and the necessity for this improvement led to the development of the wood base mentioned. In making wood base micarta veneer stock which can be carefully inspected is coated in micarta and piled up and pressed into a board of suitable thickness and length which forms a uniform laminated structure.

The mechanical strength of wood base micarta is much greater than the average mechanical strength of ash, maple or hickory. It is absolutely uniform and the dielectric strength is as good as paper base micarta. This assures the ideal lift rod, since it is not in any way affected by moisture or oil.

Highway Pay-Out Reel

A newly designed highway pay-out reel weighing 32 lb. and of sturdy constrction is announced by the Highway Trailer Company, Edgerton, Wis. The reel has folding coil arms which will permit them to be stored very easily in compact form. These arms are adjustable for three different sizes of coils, and there is a minimum friction on the wires when it is being paid out due to the small surface of the reel rim. The double coil arms prevent distortion of the coils and the reel bed spokes are slightly dished upward so that the reel rim carries the load of the coil. Several of these coils can be mounted on a trailer for use in public utility work.

Single-Conductor Type "T" Cap-Nut Terminal Potheads

A new line of single-conductor potheads, available in voltage ratings of 600, 3,000, 7,500, 15,000 and 25,000, is announced by the G. & W. Electric Specialty Company of Chicago. Each group is made for conductors in sizes up to 500,000, 1,000,000 and 2,000,000 circ.mil.

The new product uses a simple and effective design of cap-nut terminal. The connector is sweated to the end of the conductor and is anchored at the top of the porcelain. The hood-nut screws on to the connector and seats on top of the porcelain tube with a vellumoid gasket between. The top of the porcelain tube is ground off to a perfectly plain surface and the definite oil-tight seal results. There are no exposed threads as the top of the hood-nut is closed.

The aerial lugs are interchangeable in style. These lugs are split for clamping on the hood-nuts and can be furnished split for clamping the aerial conductor. The wall thickness of the hood-nuts is such that the clamping effect is communicated to the connector and the entire assembly locked. The porcelains are of new design and extra deep petticoats and provide a generous factor of safety in flashover.

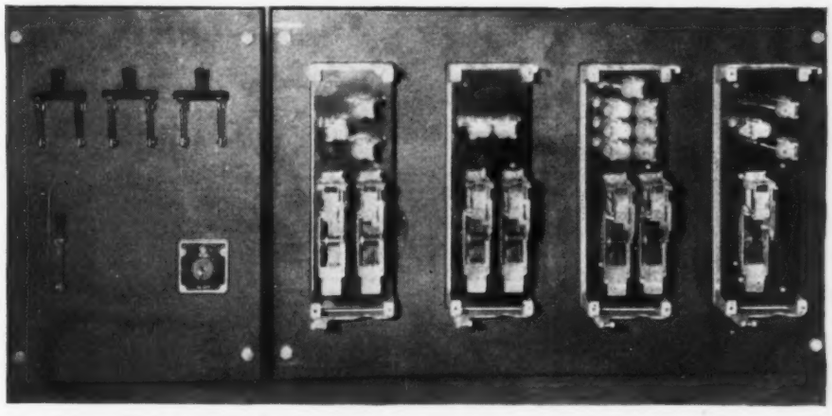
The bodies are non-magnetic castings and furnished with brackets usually cast integral with the body. The filling hole is near the bottom of the body and is on an angle. When filling the pothead with compound a short pipe is screwed into the hole. The compound is poured through the pipe and rises inside the pothead, thus insuring complete compounding with no possibility of voids. The hood-nut is left loose while compounding in order to allow the air to escape at the top.

Automatic Totalizer Announced

Automatic indication of totals of various accumulating quantities is now possible with the use of electric equipment recently perfected by the General Electric Company. The equipment, originally designed for the totalization of electric power demand originating from a large number of sources, can be applied to the quick and accurate totaling of units of several different numerical values.

The totals involved may be indicated in several places, either by means of large or small indicators. A typical application might cover the sale of tickets having different monetary values at 50 different ticket windows. Whether the sales occur successively or simultaneously, the totalizing equipment will function and correctly total all sales. Such a piece of equipment, in fact, has already been designed and built.

Indication of totals can be made on small indoor type indicators for totaliz-



ing in various numerical units. Indication may also be given on large billboard type signs where the figures are formed by electric lamps. Other possibilities are the application to turnstiles in fair grounds, in subways and in other places where it is desired to count and indicate attendance totals.

Electrical Patents

Announced by U. S. Patent Office

(Issued February 5, 1929)

1,700,831. APPLIANCE PLUG; J. B. Downing, Orange, N. J. App. filed Jan. 14, 1926. Omitted from previous listings of patents as it was received from the Patent Office too late to be included in numerical order.

(Issued April 30, 1929)

1,711,001. INDICATOR; C. E. Summers, Dayton, Ohio. App. filed April 17, 1922.

1,711,003. DAMPING MEANS FOR INDICATORS; A. W. Uhl, Brooklyn, N. Y. App. filed Sept. 16, 1924.

1,711,065. INTERCHANGEABLE LAMP BRACKET; A. A. Smith, New York, N. Y. App. filed June 9, 1927.

1,711,088. ELECTRIC FURNACE; H. Eldridge, Oakland, Calif. App. filed May 19, 1925.

1,711,101. MEANS FOR INDICATING FREQUENCY CHANGES; R. B. Shanck, Woodside, N. Y. App. filed Aug. 21, 1923.

1,711,106. AUTOMATIC RECLOSING CIRCUIT-BREAKER SYSTEM; A. E. Anderson, Scotia, N. Y. App. filed Aug. 11, 1926.

1,711,151. METHOD OF ELECTRIC ARC WELDING; J. C. Lincoln, East Cleveland, Ohio. App. filed Sept. 19, 1918.

1,711,229. SWITCH; W. O. Hampton and E. J. Thompson, Chicago, Ill. App. filed Sept. 27, 1926.

1,711,276. SIGNAL ALARM; S. J. Marchosky, Cristobal, Canal Zone. App. filed Sept. 9, 1927.

1,711,285, INDUCTION-TYPE RELAY; W. H. Petersén, Ludvika, Sweden. App. filed March 8, 1927.

1,711,323. OSCILLATING MAGNETO; R. A. Oglesby, South Bend, Ind. App. filed June 23, 1926.

1,711,335. THERMOSTATIC SIGNAL; C. F. Wentzel, Wheeling, W. Va. App. filed Aug. 10, 1925.

1,711,364. OIL-COOLED TRANSFORMER; J. Roothaan, Hayes, England. App. filed Sept. 22, 1926.

1,711,397. AUTOMATIC DISCONNECTING POT HEAD; A. C. Rumble, Los Angeles, Calif. App. filed April 4, 1927.

1,711,406. ELECTRICALLY-HEATED RECEPTACLE; E. E. Drumm, Manitowoc, Wis. App. filed May 11, 1928.

1,711,416. ELECTRO-ENDOMOSIS METHOD AND APPARATUS; V. A. Lapenta, Indianapolis, Ind. App. filed Aug. 10, 1925.

1,711,417. CANOPY SWITCH; D. M. Le Fever, Solvay Station, N. Y. App. filed Feb. 15, 1926.

1,711,423. HOUSING FOR ELECTRIC HEATING ELEMENTS; N. A. Morro, Auckland, New Zealand. App. filed Sept. 9, 1926.

1,711,462. COPPER-OXIDE ELECTRODE AND METHOD OF MAKING THE SAME; E. W. Westcott, Niagara Falls, N. Y. App. filed Nov. 10, 1925.

1,711,472. GRIDDLE HEATER OR STOVE; S. Lewin, Philadelphia, Pa. App. filed June 25, 1928.

1,711,477. TRAFFIC SIGNAL; C. A. B. Halvorson, Jr., Lynn, Mass. App. filed Oct. 31, 1924.

1,711,479 and 1,711,480. LIGHT-PROJECTING DEVICE; C. A. B. Halvorson, Jr., Lynn, Mass. Apps. filed Sept. 1 and March 18, 1925.

(Issued May 7, 1929)

Reissue 17,290. ELECTRICAL WIRING SYSTEM; E. E. Ashley, Jr., Noroton, Conn. App. filed May 5, 1925.

1,711,501. SWITCH; E. H. Jacobs, Chicago, Ill. App. filed Dec. 4, 1925.

1,711,517. ELECTRIC COOKING DEVICE; A. J. Bressan, Plainfield, N. J. App. filed Aug. 20, 1926.

1,711,521. SWITCH-OPERATING MEANS; V. R. Despard and H. C. R. Popp, Valparaiso, Ind. App. filed June 3, 1927.

1,711,534. SEAT-INDICATING SYSTEM; W. J. King, East Orange, N. J. App. filed Aug. 12, 1927.

1,711,542. CASKET; G. Rosenqvist, Pittsburgh, Pa. App. filed Nov. 18, 1926.

1,711,552. CABLE CONNECTOR; G. C. Thomas, Jr., Elizabeth, N. J. App. filed July 26, 1926.

1,711,623. ELECTRICAL FIXTURE; J. A. Volk, Jr., Norwalk, Conn. App. filed Aug. 9, 1923.

1,711,625. SWITCHING SYSTEM; R. A. Waite, Yonkers, N. Y. App. filed Jan. 19, 1926.

1,711,634. THERMAL PROTECTIVE DEVICE; O. Dreyer, Essen, Germany. App. filed Oct. 17, 1925.

1,711,657. MAGNET; E. E. Sanders, Reno, Nev. App. filed Oct. 3, 1927.

1,711,672. REMOTE CONTROL SYSTEM; L. E. Coon, Chatham, N. J. App. filed July 27, 1925.

1,711,689. ROTARY MERCURY INTERRUPTER; P. H. Pierce, Westfield, N. J. App. filed Oct. 20, 1926.

1,711,693. ELECTRIC FUSE FOR PROJECTILES; H. Rühlemann, Sommerda, Germany. App. filed Jan. 6, 1928.

1,711,709. CARBON HOLDER; J. L. Westhaver, San Diego, Calif. App. filed Oct. 29, 1927.

1,711,739. NITROCELLULOSE LACQUER FOR SEALING TOPS OF DRY CELLS; P. A. Marshal, Lakewood, Ohio. App. filed Nov. 21, 1927.

1,711,747. HIGH-TENSION-SWITCH MECHANISM; M. M. Samuels, New York. N. Y. App. filed May 8, 1926.

1,711,770. ELECTRIC SWITCH MECHANISM; T. Bocek, Brooklyn, N. Y. App. filed Oct. 6, 1926.

1,711,776. ELECTRICAL METHOD AND APPARATUS; R. N. Conwell, Bloomfield, N. J. App. filed Aug. 21, 1922.

1,711,780. COMBINATION LOCK; A. C. Findlay, Chicago, Ill. App. filed Oct. 26, 1925.

1,711,812. TIME SWITCH; H. Sanner, Chicago, Ill. App. filed Jan. 2, 1925.

1,711,816. LIGHTNING ARRESTER; G. Steerup, Chicago, Ill. App. filed June 4, 1925.

1,711,836. ELECTRIC SWITCH; H. A. Douglas, Bronson, Mich. App. filed Nov. 17, 1927.

1,711,841. MOUNTING FOR PANEL BOARDS, ETC.; F. F. Hafemeister, Cleveland, Ohio. App. filed May 28, 1924.

1,711,844. DYNAMO-ELECTRIC MACHINE; K. L. Hansen, Milwaukee, Wis. App. filed Apr. 27, 1927.

1,711,879. SHIP-GUIDING METHOD AND APPARATUS; C. D. Ehret, Philadelphia, Pa. App. filed Dec. 6, 1920.

1,711,883. ADJUSTABLE TROLLEY FROG OR SWITCH; T. B. Forsyth, Elizabeth, Pa. App. filed July 20, 1927.

1,711,912. ELECTRICAL INSTALLATION ASSEMBLAGE AND CONDUCTOR CLAMP; H. F. Vaughn and R. R. Terpening, Schenectady, N. Y. App. filed Nov. 18, 1926.

1,711,920. FIRE ALARM; R. C. Coffey, Gastonia, N. C. App. filed Oct. 30, 1926.

1,711,936. IGNITING DEVICE FOR CIGARETTE-DISPENSING CONTAINERS; A. Girtanner, Freeport, N. Y. App. filed Sept. 22, 1926.

1,711,958. ELECTROMAGNETIC RELAY; G. A. E. Lundell, New York, N. Y. App. filed March 21, 1921.

1,711,974. CURRENT-RECTIFYING DEVICE; W. O. Snelling, Allentown, Pa. App. filed Feb. 10, 1927.

1,711,979. ELECTRIC MACHINE WITH VARIABLE POLE NUMBERS; H. Weinert, Dresden-Kotzschenbroda, Germany. App. filed Sept. 18, 1926.

1,711,983. HIGH-INTENSITY FLAMING-ARC LAMP; P. R. Bassett, Brooklyn, N. Y. App. filed June 14, 1918.

1,711,995. THREADLESS CONDUIT FITTING; F. W. Erickson, Larchmont, N. Y. App. filed Nov. 14, 1927.

1,711,996. FUSE LOCK; F. W. Erickson, Larchmont, N. Y. App. filed Jan. 31, 1928.

1,712,001. ELECTRIC HEATER; A. C. Gilbert, New Haven, Conn. App. filed Oct. 16, 1922.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Prague, Czechoslovakia (No. 38,372), of bank equipment including burglar alarms, writing telegraph instruments and special telephones.

An agency is desired in Milan, Italy (No. 38,373), for electric fruit juice extractor.

An agency is desired in Hamburg, Germany (No. 38,352), for household electric appliances.

An agency is desired in Montreal, Canada (No. 38,353), for household electric appliances and another (No. 38,393), for household electric appliances.

Purchase and agency are desired in Montreal, Canada (No. 38,358), for household electric appliances.

Purchase or agency is desired in Saskatoon, Canada (No. 38,368), for household electric appliances, farm lighting plants and magnetos and wiring supplies.

Purchase is desired in Tampico, Mexico (No. 38,360), of electrical ice-cream cabinets and commercial units.

Purchase or agency is desired in Sydney, Australia (No. 38,371), for alternating-current meters.

An agency is desired in Kaiserslautern, Germany (No. 38,355), for electric paint sprayers.

An agency is desired in Johannesburg, South Africa (No. 38,312), for electric refrigerators and electric stoves.

Purchase and agency are desired in Quebec, Canada (No. 38,387), for show window reflectors and commercial lighting fixtures.

An agency is desired in Barcelona, Spain (No. 38,354), for television apparatus.

Purchase is desired in Concepcion, Chile (No. 38,369), of bare and insulated copper wire.

Purchase and agency are desired in Durban, South Africa (No. 38,389), for insulated wire and cable and resistance wires.

An agency is desired in Sao Paulo, Brazil (No. 38,394), for resistance wires for heaters.

New Trade Literature

SWITCHES, LIGHTNING ARRESTERS, ETC. — The General Electric Company, Schenectady, N. Y., has issued the following bulletins: GEA-67A describes the CR 2931 float switches for use with automatic pumping equipments for water-wheel control, GEA-156C covers the oxide-film lightning arresters, GEA-161D covers its "Novalux" types L-23, L-24, L-25, L-29, L-30 and L-31 floodlighting projectors, GEA-192D describes the G-E portable farm motor for driving belted farm machinery, GEA-212A describes its type CP air circuit breakers, GEA-594A covers the G-E automatic control panels for industrial electric heating, GEA-746C covers its hinged-type fingers for railway and industrial haulage controllers and GEA-90D which lists its automatic station installations made up to January 1, 1929, with some typical installations.

TANKS. — Bulletin No. 160 issued by H. O. Swoboda, Inc., 3400 Forbes Street, Pittsburgh, describes and illustrates its "Falcon" electrically heated large asphaltum coating tanks.

BAKELITE MOLDINGS.—The Bakelite Corporation, 247 Park Avenue, New York City, is distributing a booklet which deals with the subject of Bakelite molding materials and their uses, with a brief description of the molding process and the equipment required for the purpose.

ELECTRIC RANGE AND AUTOMATIC TOASTER.—Landers, Frary & Clark, New Britain, Conn., have issued pamphlets describing and illustrating the new "Universal" small electric range and the new "Universal" automatic toaster.

AIRPORT AND AIRWAY LIGHTING EQUIPMENT AND FLOODLIGHTS.—The Crouse-Hinds Company, Syracuse, N. Y., is distributing bulletin No. 3132 describing and illustrating its various types of airport and airway lighting equipment. Bulletin No. 2130 issued by the company and entitled "Sunbeams in the Night" contains illustrations showing the applications of floodlighting in buildings, parks, monuments, filling stations, etc.

COMMUTATOR AND MOTOR MAINTENANCE EQUIPMENT.—A catalog issued by the Ideal Commutator Dresser Company, Sycamore, Ill., describes and illustrates its complete line of commutator and motor maintenance products. It also gives the history of commutator maintenance, information on how to care for equipment at the lowest possible cost and a section is devoted to hints on commutator care.

CHOKE COILS AND FUSE MOUNTINGS. — The Champion Switch Company, Kenova, W. Va., is distributing bulletin F covering its new line of outdoor reinforced choke coils, fuse mountings and combined choke coils and fuse mountings. The bulletin contains illustrations, complete information and dimension tables.

LINE MATERIAL.—Bulletin GEA-1067 issued by the General Electric Company, Schenectady, N. Y., describes a few important line material products manufactured by the company, including line material for catenary suspension, for direct suspension for railways and for direct suspension for mines.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

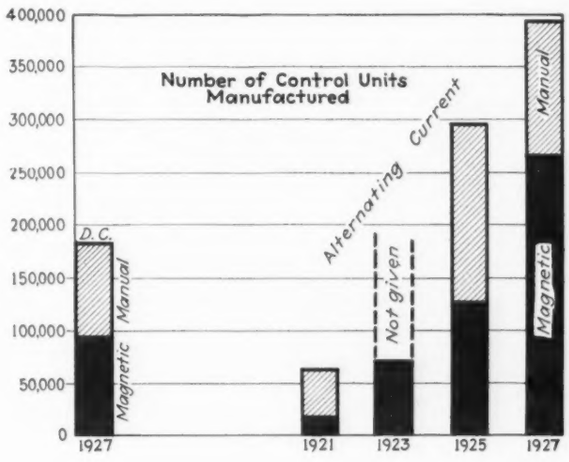
Members of the Robot Family?

ENGINEERS, contractors, manufacturers and power companies are all concerned in the markedly increased use of industrial control apparatus revealed by the Census of Manufactures. Data for 1927 have recently been published and are here compared with similar data for the three preceding enumerations.

Both in direct- and in alternating-current motor control apparatus the production was more than doubled from 1921 to 1927, as to value. From 1923 onward the changes are not so great. In both groups the totals were higher in 1927 than in 1925. Whether the extraordinarily high values for manual control apparatus in 1923 reflect an actual peak of production following the depression of 1921, or whether they are to be explained by a difference in classification cannot now be determined.

The most conspicuous fact is the rapidly increasing use of magnetic control, trebling in value in six years. In numbers, the a.-c. magnetic type trebled in four years. Statistics are lacking on the number of d.-c. units for the earlier years.

Six Years' Growth in Industrial Control



Control Apparatus Manufacture

	1921	1923	1925	1927
A.-C. magnetic	$1,486,264	$4,233,099	$5,783,926	$6,701,763
A.-C. manual	3,392,611	7,934,089	6,089,381	5,825,311
D.-C. magnetic	3,352,239	4,002,829	6,324,568	8,496,225
D.-C. manual	1,700,516	4,335,781	1,608,912	1,936,984
Regulators[1]	9,618,892	12,670,817	4,535,903	3,273,280
Controllers[2]			6,960,151	7,636,052
Total	19,550, 22	33,176,515	31,302,841	33,869,615

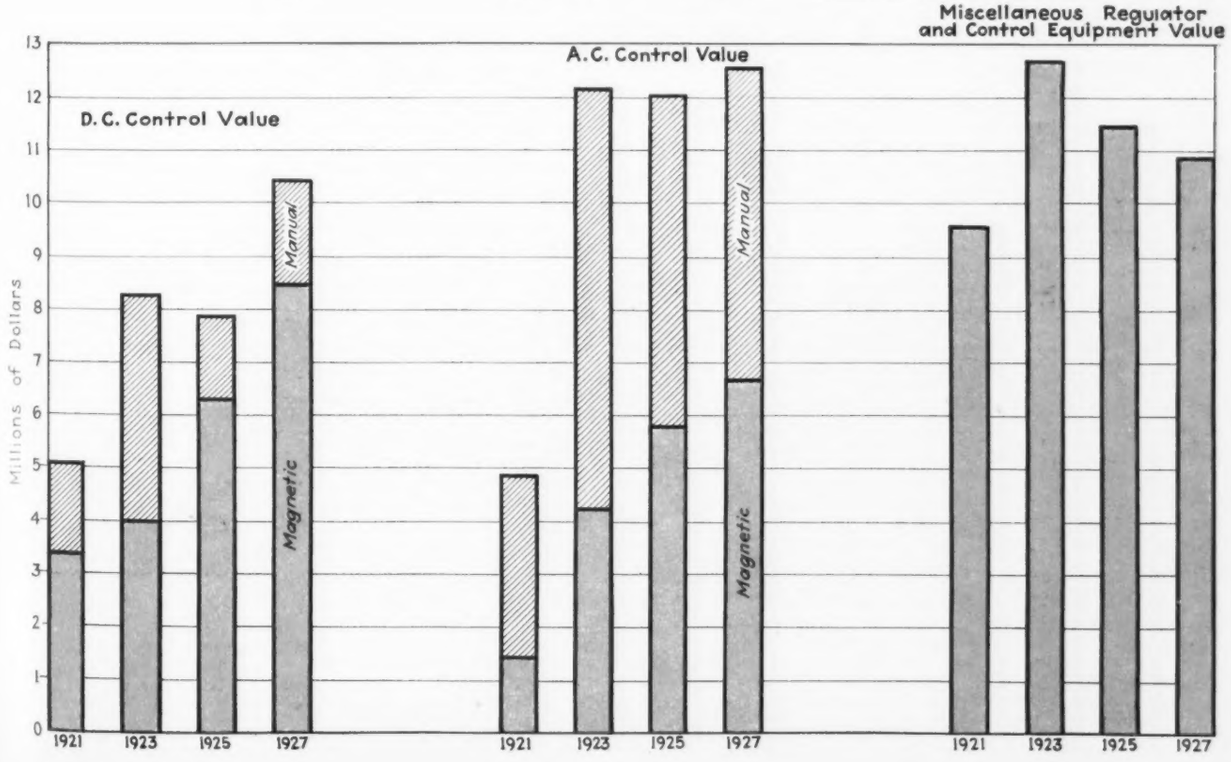
[1] Includes pressure regulators, float switches, limit switches, phase-failure relays (regulating and protective), electric brakes and miscellaneous switches.

[2] Includes railway and vehicle controllers, field rheostats, generator voltage regulators, theater dimmers, battery-charging rheostats, miscellaneous rheostats and resistance units (not including radio rheostats).

Control Apparatus Manufactured

Number of Units

	1921	1923	1925	1927
A.-C. magnetic	17,93	70,552	135,445	266,512
A.-C. manual	46,693	.....	157,554	126,195
D.-C. magnetic	.....	.....	.....	93,985
D.-C. manual	.....	.....	.....	90,564



Continued High Operations in Middle Atlantic States

PRODUCTIVE operations of the manufacturing plants in the Middle Atlantic States have been of a high order since the opening of the year. Reports received by the ELECTRICAL WORLD on electrical energy consumption by over 800 large manufacturing plants operating in the section indicate that the rate of activity during April was 1.9 per cent under March, but was 14.3 per cent over April last year. The current activity is about 4.7 per cent under the record mark set during November last year. There is now every certainty that the average rate of operations of these plants during the first half of the year will materially exceed that during the same period last year.

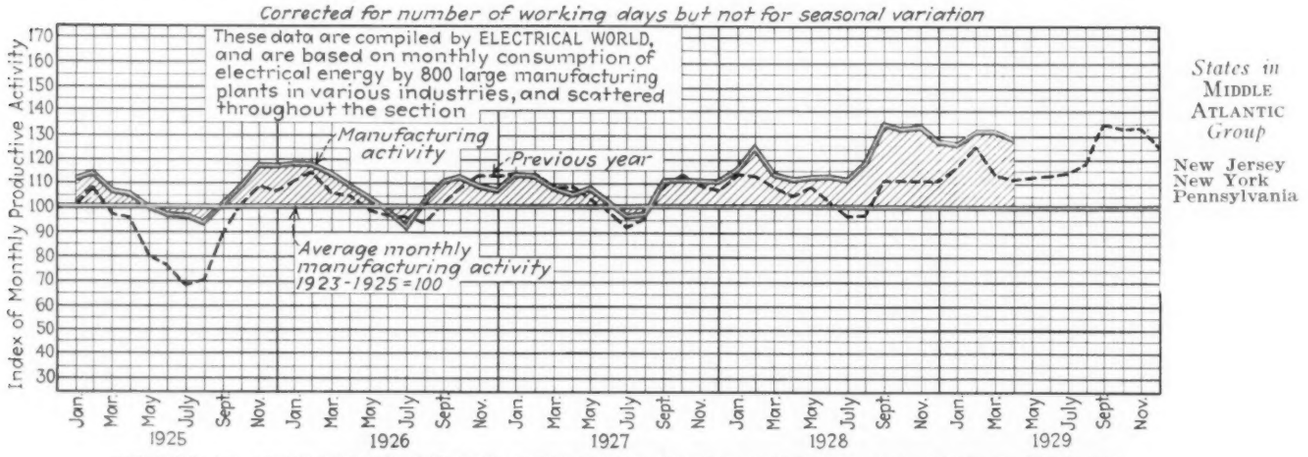
The greatest gains in activity during April were recorded by the iron and steel industry and the ferrous and non-ferrous metal-working industry. The steel industry reported a rate of operations about 40.5 per cent over April last year, although the current April operations were about 2 per cent under March. April activity in the metal-working plants of the section was 27.6 per cent over April, 1928. Three industrial groups—food products, leather products and the paper and pulp group—reported April operations under those of April last year.

Indexes of Productive Activity in the Middle Atlantic States

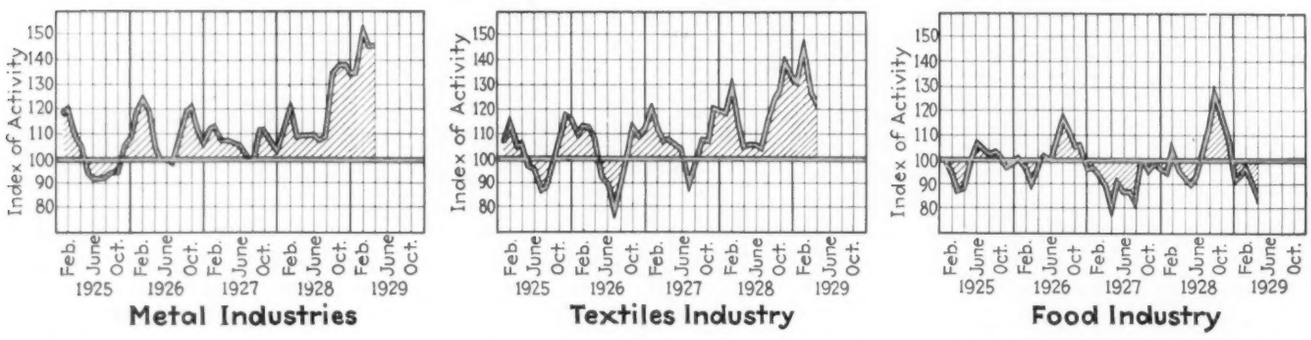
All Figures Adjusted for Number of Working Days

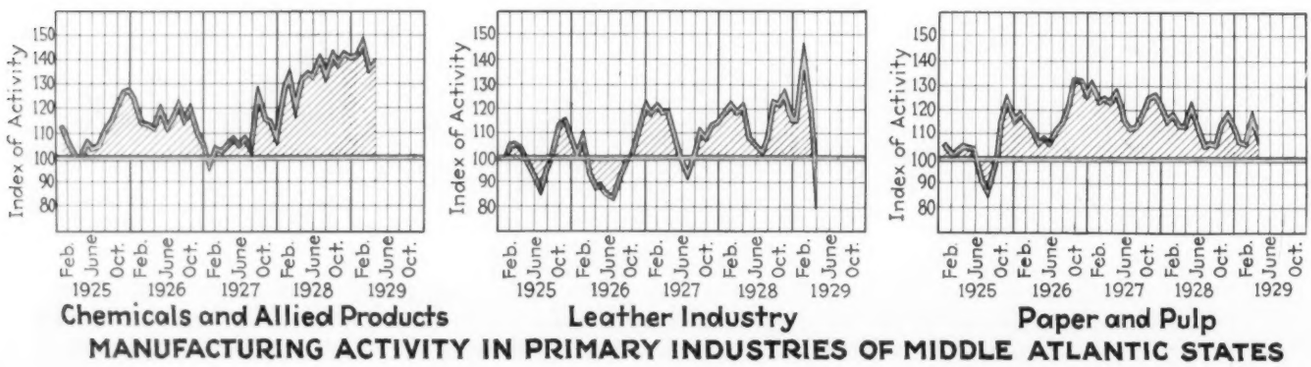
	April, 1929	March, 1929	April, 1928	Average for First Four Months 1929	Average for First Four Month 1928
All industries	128.0	130.5	112.0	128.9	117.2
Automobiles, including parts	172.9	151.8	171.2	159.3	166.4
Chemicals and allied products	139.2	134.8	133.4	140.9	131.0
Food products	83.2	91.1	92.4	91.3	95.7
Leather products	80.8	119.4	120.9	114.9	119.9
Forest products	127.7	120.2	104.5	119.5	106.9
Metal-working plants	140.2	132.3	109.9	136.3	112.2
Rolling mills and steel plants	152.3	155.4	108.4	151.2	114.4
Metals group	145.7	144.2	109.1	143.9	113.3
Paper and pulp	106.5	119.8	112.5	109.8	114.2
Stone, clay and glass	133.4	136.2	124.3	136.1	115.8
Textiles	121.3	127.7	104.0	131.2	117.0

ELECTRICAL WORLD *Barometer of Industrial Activity in the Middle Atlantic States*


Corrected for number of working days but not for seasonal variation
These data are compiled by ELECTRICAL WORLD, and are based on monthly consumption of electrical energy by 800 large manufacturing plants in various industries, and scattered throughout the section
Manufacturing activity
Previous year
Average monthly manufacturing activity 1923-1925 = 100
Index of Monthly Productive Activity
States in MIDDLE ATLANTIC Group
New Jersey
New York
Pennsylvania
1925
1926
1927
1928
1929

GENERAL MANUFACTURING ACTIVITY IN THE MIDDLE ATLANTIC STATES





MANUFACTURING ACTIVITY IN PRIMARY INDUSTRIES OF MIDDLE ATLANTIC STATES